SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LII.—No. 3. [NEW SERIES.] NEW YORK, JANUARY 17, 1885. [$3.20 per Annum. [POSTAGE PREPAID.]

OIL OF TURPENTINE AND RESIN.

This is an important industry in some of our Southern States, and the mode of gathering the materials and manufacturing them into a merchantable article is described below.

In the manufacture of oil of turpentine and resin, a convenient portion of pine land is taken, where the necessary homes are constructed, and early in January boxing the trees commences, which lasts until the last of March. All the pines over twelve inches diameter are boxed, namely, incisions are cut near the base of the tree, preferably in the south side, the boxes being about ten inches broad and made to hold from two to three pints, some trees of larger size having from three to five boxes, according to size of trunk. Oblique gutters are cut above the boxes, to convey the turpentine in as it exudes. They meet over the center of the box from each side, inclined downward. The boxes are divided into lots of 10,000 each, which is called a crop, and is placed under the supervision of a man.

The exudation commences immediately, and very soon the boxes are filled, when it is dipped by means of wooden shovels, emptied into pails, then into barrels placed in convenient places, each barrel containing 280 pounds. The boxes, when properly attended to, fill about seven times during the season, from March to October. As the exudation becomes slow new streaks are made, reaching through the bark and into the alburnum to the depth of about four concentric circles. The turpentine obtained during the first year is richer in oil, and produces the best qualities of resin; it is called "yellow dip" or "pure dip." That which congeals on the faces of the trees is scraped off in October; it contains very little oil, having lost the greater part by evaporation. During the winter the stock of oil and resin which accumulates is disposed of, and arrangements made for commencing with warm weather of the following season. The same farms are seldom worked longer than three or four years, as the trees become badly exhausted in that time, and there are new trees to work upon near at hand. The still is made of copper, varying in capacity from eight to thirty barrels, some being larger even than this. It is inclosed in a brick furnace, so that heat may circulate around it. It is supplied with a movable top, through which the "gum," or crude turpentine, is put. At the base there is a large stopcock or gateway, through which the residue is drawn after the distilling process is completed; it is also supplied with a small stopcock at top, through which the water enters. The movable top is connected with a large coil of pipe for condensing, which is immersed in a tank filled with cool water; the end of the pipe is brought through the side of the tank near the base, so as to empty its contents into a barrel for that purpose. The barrel or receiver is furnished with two openings, one near the bottom, the other near the top.

A convenient quantity of turpentine is placed in the still, being very dirty, containing leaves, sticks, etc. Heat is applied, and very soon the vapor begins to rise, and is condensed while passing through the coil; it is emptied into the receivers. At first a greater part of it is water; the water immediately falls to the bottom, because of its greater specific gravity and incompatibility; as the receiver is filled, the water is drawn out through the stopcock at the base, while the lighter volatile oil is drawn from that at top and transferred to barrels. As the distillation progresses, the quantity of water becomes small, when more is added through the top of still. This process is continued until the distillate is largely water (one part of oil to twelve of water), when the fire is removed; the movable top is also taken away, and it is allowed to stand for a few minutes until most of the water passes away; then much of the straw and sticks are removed by means of strainers on long handles; after this is done, the large stopcock is opened, and the liquid resin conveyed to strainers to remove all dirt, etc. The first strainer is, of course, wire, to remove large pieces of trash; then it is passed through cotton batting made for that purpose, lastly through a strainer made of wire gauze of No. 40 to No. 60, No. 60 being used for best qualities of resin; it is then allowed to stand in large vats until it is partly cooled, when it is removed to barrels, each containing 280 pounds. The resin from turpentine of the first year is classed "window glass," then "virgin," which are the finest qualities; the lower grades are made from "gum" of succeeding years, and often by improper distilling. The oil is put in barrels, and after being allowed to stand for a short while deposits a sediment, mostly of suspended organic matter; this is removed, the barrels sealed up, when it is ready for market. To further purify the oil, it should be distilled from caustic potassa. When the manufacture is conducted economically, says the *Independent Record*, to which we are indebted for this article, a profit is realized when twenty-five cents per gallon is received for the oil, and from two dollars to four dollars per barrel for resin, according to grade. Large quantities of these are exported yearly, and their manufacture is one of the most paying industries of those of our States so abundantly supplied with suitable trees to operate upon.

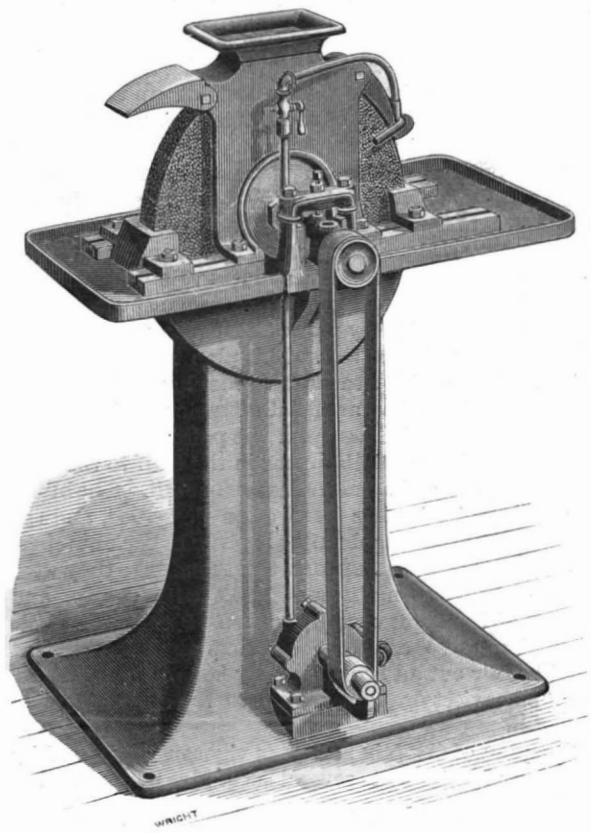

Fig. 1.—THE STILES MACHINIST'S TOOL GRINDER.

IMPROVED TOOL GRINDER AND PRESS.

By the use of corundum wheels running in water a cutting edge quite unattainable on the grindstone may be given to lathe, planer, and other tools, without affecting the temper of the steel. The frame of the tool grinder shown in the engraving is hollow, forming a reservoir for water, which is forced to the wheel by means of a self-acting pump bolted to one side of the base. Near the upper end of the tube is placed a faucet, by which the amount of water delivered to the wheel may be regulated. A flexible tube leads from the upper end of the pipe to the nozzle, which is divided and so arranged that the water may be delivered upon any desired point of the wheel or tool. The shaft is made of steel and runs in self-oiling boxes, and is accurately balanced together with the wheel, thus avoiding the necessity for a special foundation, and adapting it to use on an upper as well as lower floor. The fixture shown in Fig. 3 is made to receive a diamond tool, and is for truing up the wheel without removing it from the frame. The frame of the fixture is held in place by two bolts, the heads of which slide in grooves, as shown in Fig. 1. Journaled in two standards is a threaded shaft, eccentrically mounted upon which is a hub formed with the handle, C, at one end. The rear end of the cutting tool holder is journaled upon this hub, the set screw, A, serving to unite the two. The fixture, having been bolted to the grinder, the tool may be moved across the face of the wheel by turning the screw, and may be moved in or out by turning the eccentric hub.

For convenience in cleaning out the reservoir when necessary there is a hand hole—not shown in the cut—in the frame. These grinders are cheaper and will last longer than the ordinary grindstone, while the work they perform is of a better grade. The total weight of the tool is 700 pounds.

The press represented in Fig. 2 is a new design embodying many novel and admirable features. The pitman is wide, and fills the entire space between the bearings of the frame, thereby securing to itself a long bearing and adding strength and stiffness to the press. The device for ad-

(Continued on page 36.)

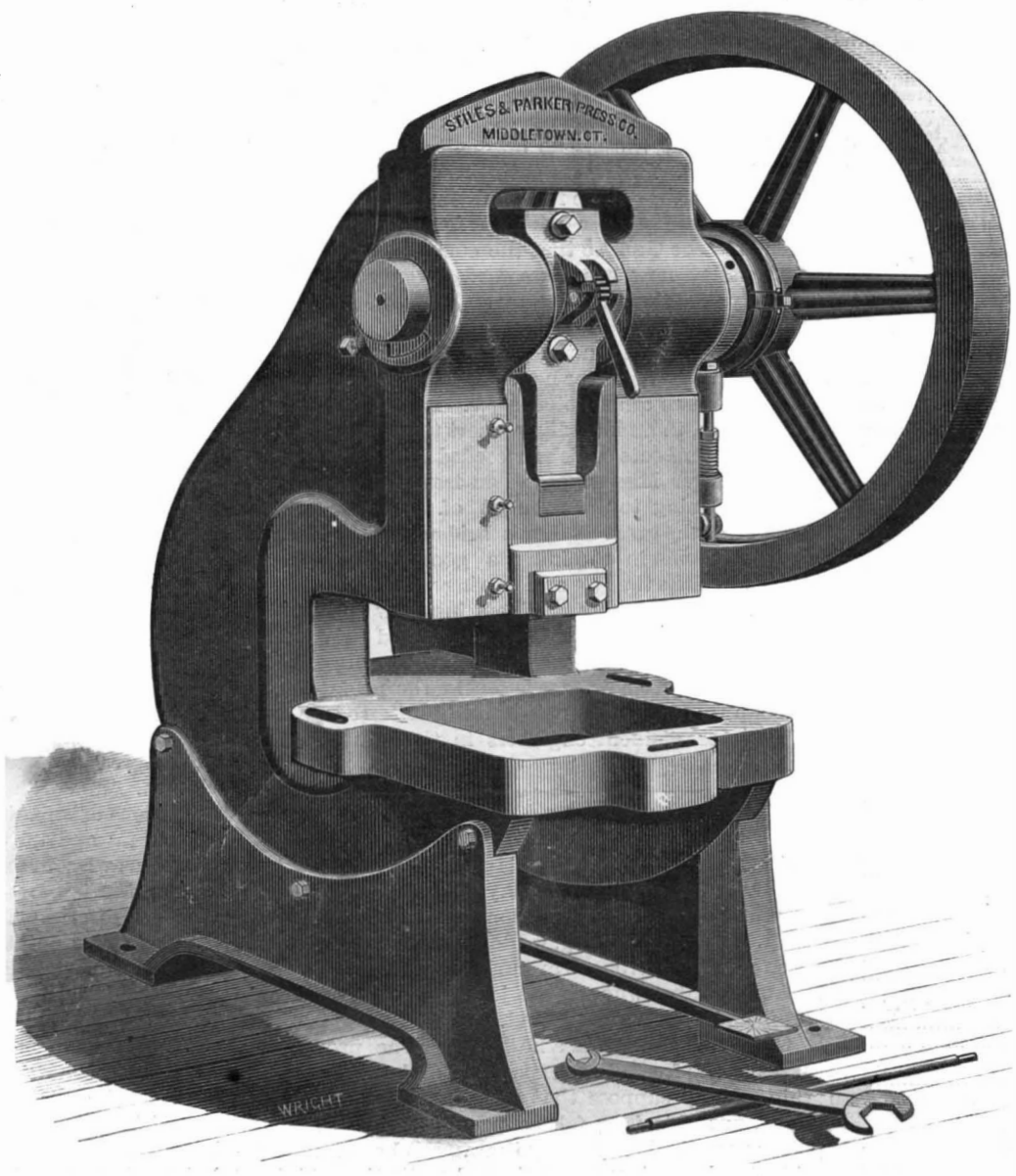

Fig. 2.—THE STILES IMPROVED PRESS.

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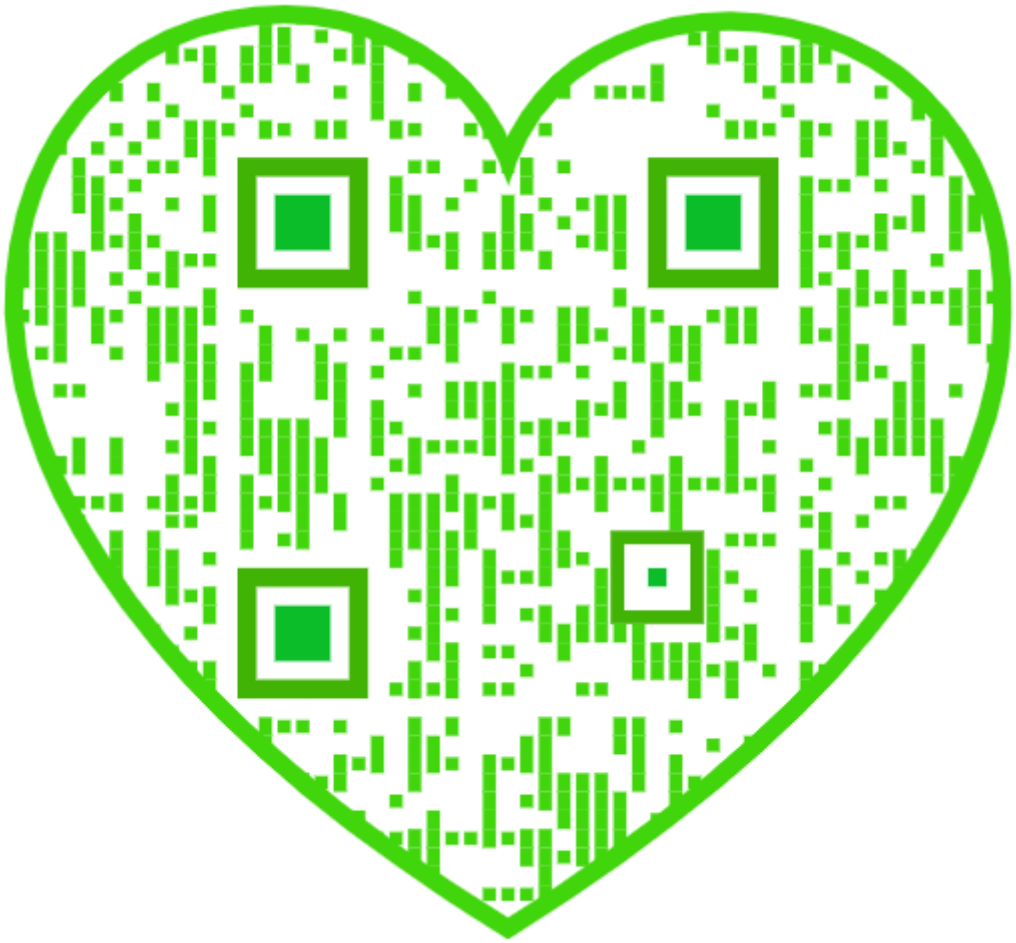

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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One copy, six months, postage included..... 1 60

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NEW YORK, SATURDAY, JANUARY 17, 1885.

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SUCCESS OF THE MISSISSIPPI JETTIES.

The attention now being given to the Tehuantepec Ship railway project of Captain Eads naturally recalls the former great engineering accomplishments of the originator of this bold scheme. Perhaps one of the most notable of these achievements was that which has so deepened and regulated one of the outlets of the Mississippi River into the Gulf of Mexico as to give free passage, at all times, for the largest vessels, up to the levees along the front of the city of New Orleans, so that even the Great Eastern, which could with difficulty be brought up to New York, will be enabled without trouble to anchor in the Mississippi off the grounds of the Exhibition buildings.

The difficulties attending the task which met Captain Eads had been for years the subject of much difference of opinion among engineers, and large sums had been expended with but little benefit. The city is 115 miles from the Gulf, and the river there was 150 deep and half a mile wide; at the head of the Passes, and about twelve miles from the Gulf, the depths were over thirty feet in the two larger Passes, and fifteen feet in the South Pass; but the depths on the crest of the bars in the Gulf, outside of the land, were, respectively, thirteen, eleven, and eight feet, at low water, and these, except as a channel was continuously dredged out, fixed the limit of draught for vessels passing up to the city. The enormous volume of the Mississippi, with the immense amount of sedimentary matter it carries, continually pushing the bars at its several mouths farther into the Gulf as this sediment was deposited in the waters where the river current almost ceased, rendered dredging operations each year more expensive, and the results obtained were of less and less value. For relief, a board of Army Engineers ten years ago suggested the cutting of a canal forty miles above the mouth of the river into an adjacent bay. This plan was met by Captain Eads' proposition to improve the channel by jetties, which would effect an artificial extension of the natural banks of the South Pass from the point where it commenced to widen and disappear in the Gulf to the crest of the bar, two and a half miles farther out. The building of these jetties has been often described, and the complete engineering details are given in back numbers of the SCIENTIFIC AMERICAN SUPPLEMENT; they were built of willow mattresses, sunk with riprap and capped at the outer ends by concrete blocks, the whole aim being to so confine the waters that the current would scour out and continuously keep clear a channel for the heaviest draught vessels to the deep waters of the Gulf.

The plan of Captain Eads was vigorously opposed by the Army Engineers in several successive reports on the subject, but the government approved the jetty system, and entered into contract with Captain Eads to carry it out, payment to be made for the work only after depths and widths of the channel specified in the contract had been obtained. On March 3, 1875 Congress passed the authorization act, and in July, 1879, the works were completed. The result has been so favorable as even to surpass the expectations of those who originally favored Captain Eads' plans. The least depth through the jetties was, last May, thirty-three feet, and the channel is steadily wearing itself deeper without forming bars at the mouth in the Gulf, so that the commerce of the Mississippi valley now has a seaward outlet comparing favorably with that afforded by any port on our Atlantic coast.

Besides his work on the jetties, Captain Eads' qualifications as an engineer have attracted public attention in at least two other noted cases. In the beginning of the war he, in an incredibly short time, provided the ironclad gunboats which succeeded in passing the forts in the lower Mississippi, when ironclad vessels were just beginning to be thought of. He was also the builder of the great St Louis bridge, which, from the difficulties met in obtaining a good foundation, was deemed at the time an engineering work of the highest order. It is especially pertinent just now to bear these facts in mind, in judging of the proposed Tehauntepec ship railway project, which seems to quite take the breath away from some of those in the profession, although its practicability is warmly indorsed by many of the most eminent engineers in this country and in Europe.

Jack Frost Bites.

Any plumber who holds his profession in high esteem should never complain of any sudden change in the weather, upon pain of expulsion from all societies of our craft. Notwithstanding, we do hear of chronic growlers, even when the zeros are around.

Any plumber who wipes a joint upon a burst is only *laying pipe* for another burst.

Cut it out and put in a new piece is the proper way. When pipes freeze they expand, and the lead becomes thin. Many suppose that the pipes burst when they thaw, but this is a false supposition. It is true the pipes never leak until they thaw. We have known incidents where pipes never thawed until the middle of June when left to thaw of their own accord.

The most economical way to thaw long lines of pipe is to abandon them, and run a new line; this will give water immediately, in the interval the old line will thaw of itself, then, when the new line freezes, you can connect on the old line.

There is nothing new or previous about this system.

When iron pipe freezes it generally splits for about a foot, while lead pipe expands for about four inches. The iron pipe necessitates the taking out an entire length from joint to joint. If the fittings are cast iron, just take a hammer and break an "L" or "T;" don't fuss trying to unscrew rusty threads.

Gas services when frozen up, disconnect at the meter, pour down half a pint of alcohol, shut off the service cock for five minutes, then open and blow gently down with your mouth; if the gas don't come, then connect your service cleaner and blow away.

An ingenious steaming apparatus has been constructed by Mr. John Haines, of Yorkville. It will save a great deal of digging where mains are frozen up. Mr. Haine's apparatus is attached to wheels, and looks like a miniature fire engine. He says it has paid for itself many times.

In very extreme cases when gas services are frozen very solid muriatic acid has been used to advantage, but care should be taken in the application of this; we do not recommend inexperienced hands to try it. All gas services should be run at an elevation from street main to meter, so that the drip should return to the main line. If impossible to run in this manner, then place a "drip plug" close to meter of sufficient length, say ten inches, of one inch pipe, with pet-cock for emptying at intervals.

Do not let the water run to prevent freezing; this is a poor precaution. Shut the water off and empty the pipes is a proper thing to do in cold weather.—*Plumbers' Trade Journal.*

Precautions against Cholera.

The first of a series of lectures dealing with precautions against cholera was delivered on December 8, at the Parkes Museum of Hygiene, London. It had been arranged that the three lectures should be divided into three parts, and that national, local, and personal precautions should be dealt with. Mr. Ernest Hart opened the series by lecturing upon national precautions. Director-General Crawford presided. In beginning his address, Mr. Hart remarked upon the increased knowledge which had been obtained in recent years in regard to cholera, and expressed the confident hope that, should cholera reach England, no such extensive suffering and mortality in our great towns as previous occasions had witnessed would occur.

Proceeding to sketch the history of international law and custom on the subject, Mr. Hart analyzed the results of the Vienna convention, and discussed separately the practices of European and Transatlantic nations in dealing with cholera. He urged that the evidence was overwhelming that European quarantine by sea, and land quarantine in any case, had invariably proved not only useless in preventing the extension of disease and loss of life, but cruel and mischievous, and had greatly added to the misery and suffering due to outbreaks of cholera. He condemned the attempts at quarantine practiced in France, Italy, and Spain, as being contrary to the experience and the knowledge of facts, as well as of science. Quarantine, he maintained, had never kept cholera out of any European country or limited it in any European district.

He proceeded to describe in detail the system of medical inspection at ports and termini, by which alone, he said, reasonable efforts might be made to prevent or limit the importation of cholera. Governments had practiced innumerable follies and insanities of quarantine, totally contrary to the rules of science, during the last epidemic. Rome, with its pure supply of water and its relatively efficient drainage, had remained free from cholera, while Naples, with its ground soil impregnated with sewage and its filthy habitations and polluted water supply, had suffered most lamentable losses. He had most excellent reasons for believing that the recent outbreak in Paris was due to the temporary supply of a highly polluted water to particular districts of the city. The prevalence of typhoid was, he declared, the true index of the liability to Asiatic cholera. Wherever typhoid prevailed, there the local conditions existed which would favor the propagation of cholera; and until typhoid fever disappeared from among us we could not consider ourselves free from the risk of the importation and the propagation of this epidemic disease. The lessons he desired to urge were: 1. That quarantine was useless. 2. That medical inspection of ports was essential, and with this should go means of isolation, compulsory notification of infectious disease, and the active exertions of all local authorities to free the districts under their control from the known conditions which rendered them liable to the extension of epidemic diseases when imported. 3. The disinfection was of most doubtful value under the known conditions of such disease. 4. That cleanliness in its fullest and widest sense was the prime element of safety.

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The Recent Telephone Decision.

Perhaps no controversy for many years has contained so large an element of mystery, so many contradictions, as that regarding the telephone. From the almost simultaneous applications at the Patent Office of two rival inventors down to the time when an obscure mechanician suddenly appeared with a cloud of witnesses to challenge the pretensions of Bell, the history of the telephone has contained chapter after chapter of surprising disclosures.

It is a human tendency to rejoice with the victors, and to regard as deserved the discomfiture of the vanquished. Yet some are doubtless to be found who, having carefully read the evidence as presented in the recent trial, will be inclined to look upon the fate of Daniel Drawbaugh as unmerited as it has been severe; and, without presuming for a moment to doubt the technical justness of Judge Wallace's decision, be slow to admit that the late defendant is either an imposter or a co-conspirator.

To the lay mind, the fact that Drawbaugh had not applied for a patent until 1880—about four years after Bell—was fatal to his cause from the start. But the truth is, if he could show, as he claimed he could, that he publicly exhibited a telephone at Eberly's Mills before 1876, then neither Bell nor any other would have been entitled to a subsequent patent, and hence he could have succeeded in having the general principle of the telephone thrown open to the public. Indeed, it is not too much to say that such a result of the recent litigation would not have greatly surprised the officers of the Bell Company themselves or some of them.

It must be said there were some grave inconsistencies in Drawbaugh's case, and some extraordinary coincidences—coincidences as startling as was that of Graham Bell and Elisha Grey hitting upon the same extraordinary contrivance at the same time, unbeknown the one to the other, and appearing at the Patent Office through their agents on the same day (Feb. 14, 1876), and within a few hours of each other. It would not be more extraordinary if two men, living the one far distant from the other, should simultaneously discover the greatest secret in the old alchemy, the transmutation of the baser metals, and be found at the same time clamoring for their rights in the corridors of the Patent Office.

The court that considered the relative claims of Grey and Bell conceded that the former possessed a practical means of transmitting articulate speech, while Bell had but the germ of a great invention, and only decided in favor of Bell because of the mistake made by Grey in depositing a *caveat* in the Patent Office instead of demanding letters patent, as Bell did. With Bell and Grey it was a matter of hair-splitting priority; but in the case of Bell and Drawbaugh, evidence was not wanting to prove that the latter constructed a "talking machine" several years before Bell claims to have done so. It rested with him to prove that Bell had not, in reality, discovered anything, and was not therefore entitled to a patent; that he had only succeeded in constructing a something already in existence, and that, like Columbus, whose claim for having discovered America is usually allowed, he had, in fact, been only a late comer. He brought to his assistance nearly one hundred witnesses from his home at Eberly's Mills and other towns in Cumberland County, Pa., who severally swore that they had either seen the "talking machine" made by Drawbaugh and heard it "speak," or had had it described to them by neighbors. And all this several years before the date in 1876 when Bell got his patent.

To judge from the reading of this evidence, the "talking machine" would seem to have been town talk in Eberly's Mills long before 1876. Nor was the apparatus a mere crude device calculated only to deceive country folk. If we are to believe the witnesses, this "talking machine" would do all the improved telephone will now do, and even the experts employed by the plaintiff agreed that the instrument as shown in court and identified by witnesses was an efficient instrument for the transmission of articulate speech.

But if Drawbaugh really invented a "talking machine," why did he not discover himself when, at the Centennial Exposition, Bell exhibited his telephone, and its extraordinary powers were heralded all over the world? Why, indeed, did he wait four years before applying at the Patent Office?

In answer to these questions, Drawbaugh says substantially that he was poor; that it costs money to make such a demonstration as would have been required; and that his townsmen, if they had before hesitated in going in with him as projectors of the "talking machine," were now decided against the project by the fear of legal entanglements. One of Drawbaugh's witnesses, hailing from another part of the State, testified that he heard of the telephone at the exposition, and supposed of course it was the one he had long before seen in the workshop at Eberly's Mills and that Drawbaugh had taken Bell into partnership with him.

The points sought to be made by the complainants were that Drawbaugh never invented any telephone prior to the exhibition made by Bell at the Centennial; that if he had any ideas regarding such a contrivance, he obtained them from that exhibition, or rather from the copy of the SCIENTIFIC AMERICAN which the witness Shapley swears he loaned him in October, 1876; that after, but not before, various mechanisms more or less similar to those constructed by Bell found their way into Drawbaugh's shop. In support of this position a deal of what might be called negative evidence was obtained by the introduction of witnesses who had visited Drawbaugh's shop between the year 1865 and the autumn of 1876 without seeing or hearing of any "talking machine."

This would seem to be the weakest part of the case for the prosecution, because surely the affirmative evidence of witnesses equally reliable that they did see and hear of the "talking machine" is more conclusive than that of their fellows who did not. Again, the claim that Drawbaugh did not use his alleged invention, save in his own shop and experimentally, will scarcely stand in the face of the mass of evidence gathered from a hundred witnesses that his "talking machine" was generally known and talked about through all the country side, and in the sense of the patent law this would seem to have made his claims public.

It must be conceded that the claim set up by Drawbaugh's friends, that he was too ignorant to understand the value of his invention, too poor to patent it, and too obscure to obtain credit or assistance, was successfully refuted by the other side. It is in evidence that during part, at least, of the very time he is alleged to have been so poor, ignorant, and unknown, he was advertising himself as a machinist with electrical machinery as a specialty, and, singularly enough, as a solicitor of patents.

Taken as a whole, this telephone case is, to say the least, extraordinary. Could this cloud of witnesses, hailing from various parts of a great county, be deceived as to what they saw or heard? Were they mistaken only in the time, but always on the right side of 1876 for the defendant, or was it a gigantic conspiracy? If so, as Senator Edmunds said, it is a fabrication as gross as the Tichborne case or that regarding the earldom of the Earl of Selkirk.

After Drawbaugh himself, perhaps the public will have been the greatest loser by the recent decision, for had the general principle of the telephone been thrown open, rival companies would have entered the field, and rates for telephonic service, now so exorbitant, would have been reduced to a reasonable figure.

The Astronomical and the Civil Day.

When midnight struck on Dec. 31, 1884, two fellow travelers who had long been tramping, one just half a length in advance of the other, linked arms and continued their unwearying journey side by side. They were the two days, the astronomical and the civil, the former adjusting his pace to that of the latter, falling back twelve hours to get in step. So the astronomical day that began at noon, Dec. 31, was only a half day, and at its end the hands of the great twenty-four hour clock at Greenwich were turned back to begin anew, and corresponding changes were made at other observatories throughout the world, in accord with the recommendation of the late conference at Washington.

Hitherto the astronomical day has begun and ended at noon, with the successive returnings of the same terrestrial meridian to the center of the sun's disk. The civil day has begun and ended at midnight. The recent change was confined to marking the astronomical day from midnight to midnight. And the great timepiece on Greenwich Hill, as well as those in other observatories, will continue to be regulated by observing the precise instant of the sun's passage across the meridian, the meridian being represented by an exquisitely slender filament of cob-web stretched across the object glass of the transit instrument.—*Tribune.*

A New Process for Toughening Steel.

The French Societe d'Encouragement have had under prolonged examination a process, invented by M. Clemandot, for working steel. The process is described by the *Revue Industrielle* as consisting in heating the metal until it acquires a sufficient ducility, and then subjecting it to high pressure during cooling. In this way a modification of the structure of the metal is produced, and the material acquires properties analogous to those developed by tempering. Similar processes have been tried in France, but only upon the same principle—that is to say, by operating upon the metal while yet in the state of fusion. M. Clemandot, on the contrary, takes steel already made, heats it simply to a cherry red, and submits it, by means of a hydraulic press, to pressures of from 1,000 to 3,000 kilos. per square centimeter. After having allowed the steel to cool between the two plates of the press, it is withdrawn with all its new qualities perfectly developed, and does not require any further treatment. The result of the process is to impart to the steel a fineness of grain, a degree of hardness, and a notable accession of strength to withstand rupture. This alteration is most considerable with highly carbonated steel; and in this respect the metal is made to resemble tempered steel, without being in all points identical with it. The cause of the alteration in physical condition is ascribed to the rapid heating and no less rapid cooling of the metal. When the red-hot steel is first strongly compressed, the conversion of the mechanical energy into heat serves to raise the temperature of the entire mass, at the same time that the particles of the metal are more closely cemented together. This effect is followed by a rapid cooling, due to the contact of the plates of the hydraulic press with the surfaces of the metal. The close pressure materially increases this conducting effect of the cold metal.

A Talk on Slate.

"Few people have any idea of the magnitude of the slate industry in this country. Until a few years since, the product of the different slate quarries in the United States was quite limited. Now the total amount produced, of roofing-slate alone, is about 500,000 squares per year. A 'square' is 100 square feet, or sufficient to cover a space 10 feet by 10 feet, when laid on the roof. It covers the same area as 1,000 shingles, and sells for from $3.50 to $4.50 per square.

"As a roofing material slate is becoming more generally used, as it lasts a lifetime, is fire-proof, needs no painting, and renders rain-water pure and untainted. Besides the large amount of roofing-slate produced, a great deal is used for other building purposes, such as window-sills, steps, floors, and mantels. Billiard table beds are now made exclusively of slate, and it is also used largely for flagging."

"Where is most of the slate quarried?" was asked.

"Well, most of the quarries are in eastern Pennsylvania—in Northampton and Lehigh counties. More than one-half of the total product of the United States comes from that region. Maine and Vermont produce small quantities. There are also small beds of slate in Michigan and Virginia. The quarries at Bangor, Pa., in Northampton County, are considered superior to any, as the slate is tough, durable, and of an unfading dark blue-black color. The quarries there are valued at from $50,000 to $500,000 each.

"Over 3,000 men are employed in eastern Pennsylvania, and the number is fast increasing, as new quarries are opened and developed. The workmen are mostly Welsh and English. They earn good wages, have comfortable homes, and are a happy, sober, and industrious class.

"The slate is first blasted out, then hoisted by steam power in large irregular shaped blocks to the bank. These blocks are then broken or 'scalloped' into smaller blocks; then split into sheets of required thickness. For that purpose, a chisel or knife, about 18 inches long, resembling a large putty knife, is used. The slate splits readily whenever the knife is put in, if inserted when the block is wet, or 'green' as it is called.

"The workmen speak of the original moisture in the slate as 'sap.' After the blocks are dry, they harden and cannot be split.

"After the blocks are split, the sheets are dressed or trimmed with a machine worked by foot-power, to the required size, which is from 6 by 12 inches to 14 by 24 inches. They are then shipped to all parts of the Union and to the Old World. A great deal of slate goes to Australia.

"When beds are found, the slate is in inexhaustible quantities, and improves in quality as the depth of the quarry increases."—*No. Chatauqua News.*

THE old publishing house of Henry Carey Baird & Co., of Philadelphia, well known for its publications on engineering, mining, manufacturing, and other industrial subjects, celebrates the centennial anniversary of its founding on January 25.

Mr. Baird, the present representative of the above firm, comes from a line of eminent writers on political economy upon both his father's and his mother's side, he being a grandson of the late Matthew Baird and a near kinsman of Henry C. Carey, both of whose writings are familiar to the older readers of the SCIENTIFIC AMERICAN.

Both families adhered to the principles of protection with steadfastness, and the present Mr. Baird, now 54 years old, besides conducting his extensive publishing business, finds time to write exhaustive articles for encyclopedias and magazines.

Unique Advertising.

A British pill manufacturer has sent 10,000 handbills concerning his business to Gen. Wolseley, with a check for £150, the handbills for distribution among the soldiers and the money to be paid to the one who shall first post one of the bills upon the door of Gordon's palace at Khartoum. The man of pills also agrees to advertise the name of the winner in every paper in England.

THE Oil Well Supply Company, of Bradford and Oil City, Pa., have published probably the most complete catalogue of machinery, tools, and supplies used in drilling and operating artesian wells for oil or water, or to test land for coal or other minerals, that was ever issued from the press. It is amply illustrated, and gives many valuable details on well boring.

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The Painless Extinction of Life of Animals.

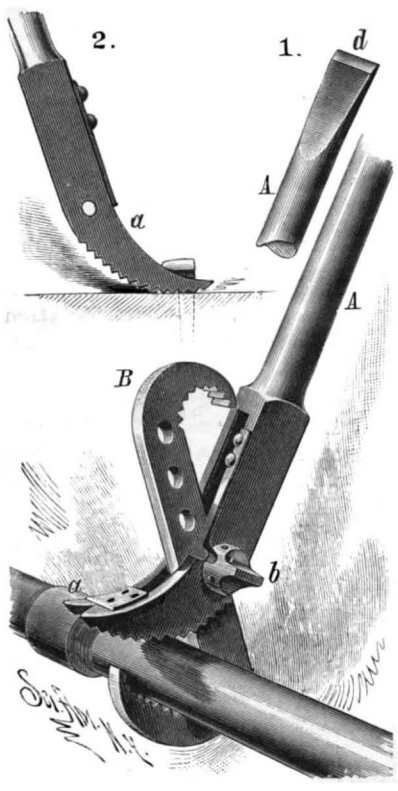
Dr. Richardson, of London, in a lecture on his process of painless killing of the lower animals, said in the closing passages of his discourse that at the Dogs' Home over 6,000 dogs have during the past seven months slept their final sleep, knowing as little of their deaths as of their births. The principal agent used for the narcotic action is carbonic oxide, passing, at summer heat, over a mixture of chloroform and carbon bisulphide into a lethal chamber, in which chamber as many as 100 dogs can at once receive euthanasia. This is on the large scale; but Dr. Richardson described also a small apparatus in which from one to six animals can be painlessly killed, and which is so portable that it can be wheeled from a central station to any house or street ready for immediate use. Thus every village and town may be provided at a small cost with a means that will give painless death to any domestic animal without offending the most sensitive individual. By an extension of the same design the author next intends to apply it to animals of the larger kind that are used for human food. It is no contemptible part of its history in this century for the profession to leave, as a bequest to the future, the means of taking the sting of death from all the lower animals whose fate is under our control.

Peroxide of Hydrogen as a Beer Preservative.

Since peroxide of hydrogen has been recommended as a good preservative for beer, the following experiments by Weingartner will be of interest to our readers, although only negative results were obtained. Some flasks of beer treated with hydrogen peroxide became clouded, while some pasteurized samples remained perfectly clear; the taste of the beer had changed to a flavor of rum, a microscopic examination showing much albumen and many living yeast cells. In another series, nine flasks of beer, to which had been added 3, 5, 6, 7, 8, 9, and 10 c. c. hydrogen peroxide, were placed on board a ship for a sea voyage lasting a month; they were daily inspected as to color and transparency; three days after commencement of the voyage two flasks which were not so treated, but kept as control, became muddy; the nine flasks treated with hydrogen peroxide remained clear and bright throughout the voyage; but on opening the flasks four days afterward, during very hot weather, it was found that the beer became clouded, although the taste and aroma remained good.

IMPROVED PIPE WRENCH.

The handle bar, A, of the wrench has a curved foot, and is slotted to receive the arm, B, which is held in place by a pivot pin, *b*, that is held by a spring catch which allows its ready removal. The arm has both ends made hook shaped—one being larger than the other—and is made with three or more holes for the pivot pin, so that the end in use can be set nearer to or farther



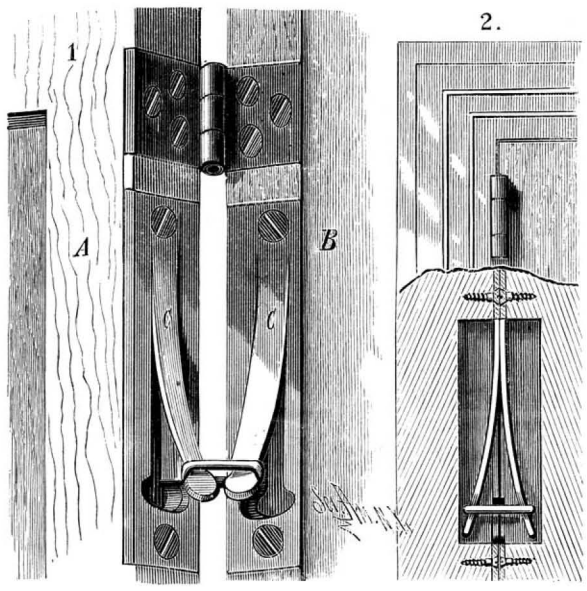
MORRISON'S IMPROVED PIPE WRENCH.

from the serrated end of the foot. The arm is to be reversed end for end, according to the size of pipe, and, with its endwise adjustment, adapts the wrench for a large range of work. Pipe fitters usually have to carry separate chisel bars and nail drawers, and in order to save this extra weight and expense the outer end, *d*, of the bar is tapered, so as to serve as a chisel bar or screw driver, and the curved end of the foot, *a*, is made with a notch, so that the bar can be used for drawing spikes and nails, as indicated in Fig. 2.

This invention has been patented by Mr. W. S. Morrison, and further particulars may be obtained by addressing Mr. James Lond, of 1101 Main Street, Fort Worth, Texas.

DOOR SPRING.

Let into and fastened to the edge of the door and the side of the jamb-rabbet are the like plates, C, which have spring tongues formed by slitting or pressing the plates by suitable dies. The free ends of the tongues are formed with notches which connect with a link. Normally, the free ends of the tongues lie back of the plane of the plates, the door and jamb being recessed to permit their entrance, as shown in the sectional elevation, Fig. 2. By this construction the tongues have a drawing or pulling action on each other, when the door is shut, to hold it firmly closed. It is evident that when the door is opened the tongues will be drawn outward



CLARK'S DOOR SPRING.

by the link and put in greater tension, so that on releasing the door they will act instantly to close it. The link, by its rounded ends, adjusts itself in the notches as they change their positions relatively to each other as the door is opened. The spring is wholly concealed from view, is positive and efficient, and can be cheaply made from suitable spring metal plates.

This invention has been patented by Mr. Enoch H. Clark, of Greenland, N. H.

Limited Use of Lumber in Mexico.

United States Consul Winslow, of Guerrero, writes that the amount of timber useful for manufacturing purposes in Northern and Central Mexico is very limited. The mesquite, the principal native product, although it is a very hard wood, and capable of taking a fine polish, is not suitable for general manufacturing purposes, as the trunk and branches are very crooked, and a straight piece of over two yards long seldom occurs. It is used, however, for making doors, door frames, for railroad ties, and for the heavy beams placed over the doors to support the stone walls, and for a number of other articles for which long lumber is not required. Its hardness, color, susceptibility of taking a fine polish, recommend it as useful for veneering, for making clocks, sewing machines, tool handles, and some articles of furniture.

There is, and will be, a demand for lumber, especially pine lumber, at those points reached by the Mexican Central, National, and International railroads, as new towns are being built along these roads; and, besides, large quantities of lumber are used in the mines and in the construction of bridges. All this lumber must come from the United States, but then the demand is not so great as may be supposed, as the manner in which Mexican houses are built must be taken into consideration. The houses, with but few exceptions, are of one story, some twenty feet high, and from twelve to fifteen wide, with flat roofs; built of blocks of stone, with walls two feet thick. The floors are made of a concrete, consisting of lime, sand, small stones, and water mixed together. The ground having been leveled where the floor is to be made, this composition is spread evenly over the surface, is allowed to dry somewhat, and is then beaten down by heavy wooden pestles, and afterward when nearly dry is smoothed down and polished by rubbing it over with round blue limestone. This requires considerable time and patience. The floor when thus made is smooth and glossy and hard, and will last twenty years. Wood floors are not suitable for this country, as they are liable to be eaten by insects, and afford a hiding place for vermin. The walls are plastered inside and outside, and whitewashed. The roof is made by extending joists from one wall to another, so that the joists show inside, and on the principal joist is painted date of building and some religious or political motto. Over the joists is nailed a flooring of boards, so that the flooring of a Mexican house is really on the roof. Over the roof is spread a composition, similar to that of the floor, which is also beaten down, so that the house becomes perfectly watertight and fireproof, and will easily last a hundred years. For example, the house in which the Consul lives was built in 1778. The roofing is of sabine and the doors of mesquite, and they are still sound. The houses consist generally of one room, some ten or twelve yards long, with sometimes another attached, as a kitchen; but the kitchen is most frequently made of adobe, and thatched with straw, and is in the back yard, retired from the house. The houses of the poorer class are made of adobe, or of sticks stuck in the ground and plastered with mud.

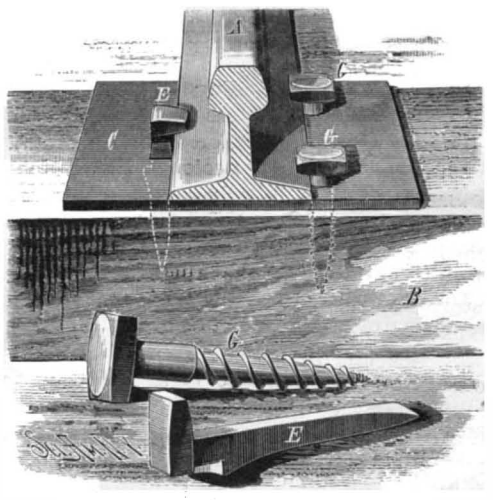
The kinds of lumber best to ship to Mexico are joists, two by twelve inches and sixteen and twenty feet long; pine and cypress boarding, one inch thick and twelve inches wide; scantling, two inches thick and four inches wide; double doors, one and three-quarters of an inch thick, six and a half feet high, one foot and a half wide; Venetian blinds for doors; shingles; oak, hickory, and ash lumber, three to four inches thick and ten to twelve feet long; materials for making carts; cart and carriage wheels, etc.

Expenses of Business.

A well informed merchant of Boston recently said to a representative of the Boston *Herald* that he had been looking back over his accounts, and was surprised to find that since the close of the war there had been a steady increase in the ordinary expenses of carrying on business. Mere office work cost a great deal more now than it did in 1865; more clerks were needed, and, on the whole, each of these received higher pay. Assistance was required in the receiving and delivering departments to an extent and of a character that would not have been dreamed of two decades ago. Then there were a variety of incidental expenses that now entered into the compilation. There were telephone charges, printing, the expense of solicitors, the whole making up an amount sufficiently large to eat up all that would have been considered fair profits a quarter of a century ago. It is probable that the experience in different trades varies, and yet we fancy that in most lines of business statements somewhat similar to the above might be made. The tendency, all the time going on, to lessen the hours of service, both in offices and workshops, would of itself make the cost of business proportionately higher. The cheapening process, if there is one, would seem to be in enlarging the amount of business which each concern carries on.

A NOVEL RAIL FASTENING.

For ordinary railway tracks and traffic the preferred dimensions for the wear plate, C, are 14 inches long, 6 to 7 inches wide, and about ⅜ of an inch thick; but the size may vary with the hardness of the tie, one of hard wood not requiring so large or thick a plate. Next to the outside flange of the rail is punched a rectangular hole in the plate, through which the spike, E, is driven, and next to the inside flange are punched two round holes, through which the screws, G, are turned down into the tie. The spike and screws are so arranged as to take a triangular hold on the base of the rail. The spike has a projecting lip at the back, with a square shoulder formed at a distance from the under side of the head corresponding to the thickness of the flange and plate. In laying the rails they will be set on the plates, which will be placed so that the inner ends of the spike holes will lie about in line with the edge of the outside flange. The spikes will then be driven home, which will bring the shoulder just below the under surface of the wear plate, which will then be driven inward until the outer end of the slot comes



HOWE'S NOVEL RAIL FASTENING.

against the spike above the shoulder. By this means the rail is locked to the plate and tie by the spike, which is also locked by the plate. The screws are now turned down until their heads rest upon the flanges, to complete the fastening. It will be seen that a spreading of the rails is prevented, since the edge of the outside flange comes against the side of the spike below its head, and the screws have a firm downward hold on the inside flange. With this device fewer ties may be used, and those used will last longer. When considered necessary, the wear plates may extend along the tie from one side rail to the other under both rails.

This invention has been patented by Mr. John Howe, of Newhall, California.

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Lake Moeris.

A very interesting lecture on the great reservoir of the Patriarch Joseph was recently given in this city by Mr. Cope Whitehouse.

The lecturer described the situation of the enormous reservoir in the district now called the Fayoum, some seventy miles southwest of Cairo, and told how it was filled through the Bahr Jousuf—the Canal of the Patriarch Joseph—at the season of the Nile inundation, and how the water, retained after the Nile had subsided by locks and the famous dike or causeway, assured life and fertility to those portions of old Egypt by irrigation. The lake was 450 miles in circumference and 300 feet deep in the deepest part. In it stood, on an island, two pyramids as high as the water was deep; and beside it was the marvelous labyrinth, of which the site is not yet identified with certainty. Tradition tells of the foundation of this vast and beneficent work through the jealousy of Egyptian courtiers of the Patriarch Joseph, already advanced in years. In answer to their complaints, Pharaoh asked them to suggest a task to try Joseph's ability. They concocted the idea of the future reservoir, thinking its creation an impossibility. Joseph accepted the test, and carried it to a successful issue. Doubtless the children of Israel worked upon the Bahr Jousuf, and upon the great dike against which Strabo describes the dashing of the waves. The Bahr Jousuf has long since become choked with silt; but it would not be an undertaking of stupendous difficulty to modern engineers to reopen it, and to restore to impoverished Egypt the priceless benefit of the Mother Lake.

Not the least interesting portion of the lecture was occupied with a description of former incomplete and erroneous identifications of the site of Moeris, due to distrust of ancient authorities and to insufficient exploration of the ground. Mr. Whitehouse told of his own three visits to Egypt and his repeated expeditions into the desert, several of which were made at some hazard during the troubled ascendency of Arabi.

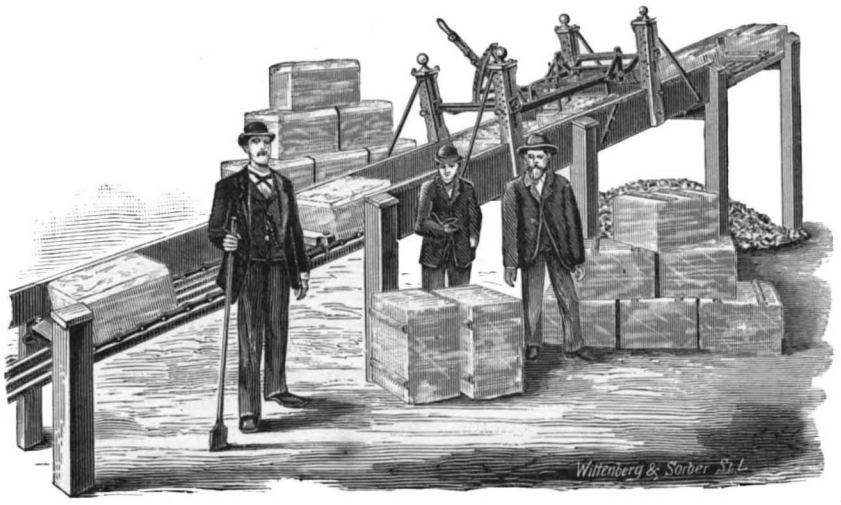
A part of the lecture was devoted to the display and explanation of a number of beautiful and interesting lantern slides, illustrating his last journey to the desert, beginning with the start from Cairo. The weird desolation of the arid waste, with its white sand resting upon the dark rocks close to the scenes once of luxuriant fertility, was brought thoroughly home to the spectators.

Photography in Banking.

It is said that the Bank of France has an invisible studio in a gallery behind the cashiers, so that at a signal from one of them any suspected customer will instantly have his picture taken without his own knowledge. The camera has also become very useful in the detection of frauds, a word or figure that to the eye seemed completely erased being clearly reproduced in photographs of the document that had been tampered with.

ICE PLANING AND RIDGING MACHINE.

Those who have attempted to clear an ice field of frozen snow, have attempted to pack ice blocks irregular in shape and uneven in size, and those who have tried to remove cakes, of a marketable size and appearance, from the ice house packed in the old way, know the difficulties to be overcome, and can appreciate the value of an apparatus which saves time and money by doing away with these hinderances. The accompanying engraving shows a planer and ridger which can be quickly attached to the inclined plane or elevator, and the use of which does away with all scraping or shoveling on the field. As the cake of ice passes under the machine the top is cleared of snow and slush, and two half-round ridges are formed, ¾ of an inch high by 2 inches wide, 5 inches from the edge of the cake. In storing on the flat these ridges form an air space of ¾ of an inch between the top of one tier and the bottom of the tier above it; and in storing on edge, the cakes can be put up close, as the ridges will make a space, and in the summer they can be taken out as cheaply and in as perfect condition as if stowed flat.



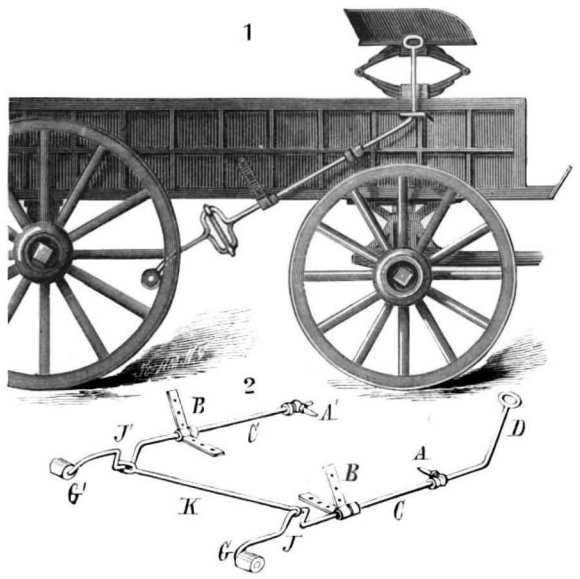
SMITH'S ICE PLANING AND RIDGING MACHINE.

The knives make three separate cuts on the top of the cake, the cutting strain being one horse power when the machine is cutting to its full capacity of 3½ inches. By means of a lever the gauge of the cut may be instantly changed anywhere from ½ to 3½ inches, and when the ice is running the same thickness the knives may be set to cut the requisite depth, when the machine will need no further attention. Ice from 7½ to 30 inches can be planed. All the parts are numbered, so that, should any one piece break, another could be ordered by telegraph.

Additional particulars regarding this machine, which was awarded first premium at the St. Louis Fair, held in October last year, may be obtained by addressing the inventor and manufacturer, Mr. Stephen L. Smith, No. 817 N. 7th Street, St. Louis, Mo.

VEHICLE BRAKE.

Fig. 1 is a side view of a wagon provided with this brake, which is shown detached in Fig. 2. The brake bar, C, is held at one side of the vehicle body in the eye of the bolt, A, and the eye of the strap iron, B, the upper end of the bar being bent to form a handle. Endwise movement of the bar is prevented by two collars placed between the eyes. The lower end of the bar is curved downward, and is then bent outward to form an arm, G, on which is placed a rubber cushion to prevent damage to the spokes as the arm is swung in between two of them, to lock the wheel when the wagon is on a down grade. When the handle is pulled toward the wagon, the arm will be turned out to enter between the spokes; and when the handle is released or pushed outward, the arm will fall clear of the wheel. The handle is prevented from falling out of reach by a keeper secured to the body. The strap, B, is made with angle plates that are fastened to the side and bottom of the box, so as better to resist the strain brought on the brake bar.



SCOTT'S VEHICLE BRAKE.

In some classes of heavy vehicles it may be desirable to have a brake rod at each side of the box to lock opposite wheels. The construction of such a brake is clearly shown in Fig. 2. In order that both arms may be operated by the same handle, reverse cranks, J J′, are formed in the brake bars. These cranks are connected by a tie rod, K, so that when the handle is moved toward the seat the arms, G G′, will be turned outward between two spokes of opposite wheels, thus locking them both at once. This brake device is simple, strong, easy to operate, and effective to lock the wheels at the point of junction of a spoke with the felly of the wheel.

Particulars regarding this invention, which has been patented by Mr. T. J. Scott, may be had by addressing Mr. W. A. McDonald, P. O. Box 12, Ashland, Miss.

Snake Dance of the Moquis.

In the month of August every year the Moquis, who live in caves in the hillsides of northeastern Arizona, celebrate a snake dance. Eight days before the dance the young men go north one day, west one day, south one day, east one day, and the other four days they roam all over the country, if necessary, to catch the snakes, using all kinds.

These reptiles are placed in an estufa until wanted, kept in order by certain old men who have no other weapon except a small stick, at the end of which are two eagle feathers. The snakes are afraid of the birds of prey, and seem to have a wholesome dread even of their feathers. After the most elaborate preparation, the dancers march through the principal streets, certain of them carrying each a squirming snake in his mouth, the animal being kept in order by a companion using the eagle quill teaser.

A Subterranean River in Austria.

The river Reka, rising in the Schneeberg, in Carniolo, suddenly disappears in the so-called Karst caverns. At San Giovanni di Duino, 20 miles distant from the spot where the Reka is lost, a river of corresponding magnitude is found issuing from the foot of a hill. This stream is known as the Timavo, which takes a westward course, and discharges its waters into the Bay of Monfalcone. As to the identity of the Timavo with the Reka there has hardly been any doubt, although until last year no attempt had ever been made practically to demonstrate the fact. The members of the Austro-German Alpine Club last year made three attempts to explore this subterranean river.

Starting from the first great cavern, called Rudolph's Dome, the expedition, consisting of four persons in two boats, proceeded on their eventful voyage. From the cavern just mentioned the river flows for 200 ft. through a narrow channel between two perpendicular walls of rock, estimated to be upward of 100 yards in height. At the end of this channel the explorers, whose course throughout was illuminated by the magnesium light, found themselves in a vast cavern, where they were able to land. The explorers, proceeding, found seven waterfalls, the last one of which, at a distance of about a furlong from the entrance, they were unable to pass, but will renew the attempt this year with more complete apparatus.

The cavern which was discovered is of far greater dimensions than the Rudolph's Dome or any of the other caves of the district. Its height is upward of 450 ft., so that it could easily contain the cathedral of St. Peter's at Rome.

The Electrolytic Process in Connection with Colors.

At the Industrial Society of Mulhouse meeting of October 8, 1884, M. Goppelsroder sent in two memoirs on the formation of oxycellulose and on that of persulphocyanogen by the electrolytic process. In the former paper he shows that if cotton is soaked in a solution of potassium or sodium nitrate, chloride, or chlorate, whether acid, neutral, or alkaline, placed upon 8 or 16 folds of moist tissue resting on a sheet of platinum which serves as the negative electrode, while there is placed above another sheet of platinum forming the positive electrode, and the current is passed, the cloth is converted into oxycellulose in the parts touched by the positive electrode. In discharging Turkey-reds or vat blues by the electrolytic process the cloth is weakened in the discharged parts by the formation of oxycellulose. In the second memoir the author describes the formation of persulphocyanogen by the electrolysis of a boiling solution of potassium sulphocyanide. He shows that this body may be simultaneously formed and fixed electrolytically upon cloth, either white, or dyed a Turkey-red or a vat blue.

A. Scheurer described the power of the alkaline hypobromates of discharging indigo blues. Upon this coloring matter they act much more energetically than the corresponding hypochlorates. With certain other colors, *e. g.*, that of raw cotton, this is not the case.

Prizes for Inventors.

A member of the French Legislature has proposed a prize of $1,000 each for the best essays by inventors on several important subjects, to which a good deal of attention has already been paid in Europe as well as here. One of these prizes is to be for a practical method of producing aluminum at a low cost, a field in which many times the proposed prize has been expended, and which has been the object of special research by eminent scientists. All but one of the systems for its production now require the use of sodium, itself an expensive metal, and the Jablochkoff system for its production by electricity is also costly. Another proposed subject of one of the prizes is a simple small motive power, for the best style of which so many inventors have long been striving. We think the individual who should succeed in obtaining the results desired by this "generous" offer would hardly be liberal enough to donate it to the world for the prize offered, so long as the patent laws, in France as well as here, would render his discovery worth many hundred if not many thousand times more.

WHEN nervous wakefulness ensues at night time, when there is a desire to sleep, but, on account of a peculiar state of mind and body, rest will not come, inhalation of pure air is a safe and efficient soporific. It is observed in these conditions that a person only breathes half-way, and that the oxygen in the lungs is kept exhausted. A physician recommends a few full respirations as the best remedy for this kind of wakefulness, which is produced frequently by the condition of the atmosphere as well as state of the mind.

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IMPROVED TOOL GRINDER AND PRESS.

(*Continued from first page.*)

justing the pitman is another new feature; instead of holes being drilled in the eccentric to receive a bar for moving, as in the old style of these presses, gear teeth are cut one-half way round in the center of the disk, and a pinion formed on the end of a handle enters a recess made to receive it, so that by the movement of the handle up or down the punch can be brought to any desired position. This handle can be removed when not in use.

The shaft is not held in place by boxes, the bearings being bored straight through the solid frame, into which is inserted a circular shoe, set up with screws to take up the wear and to produce friction sufficient to overcome the momentum, thus dispensing with any special device for accomplishing the latter purpose. This construction makes the frame much stronger than if cut out to receive a cap to hold the shaft in place, and also allows the shaft to be much larger, making a stronger and more durable press. The shoe is chambered for the reception of oil, thus keeping the shaft well lubricated. The press is provided with a patent stop motion, by which the shaft can be turned to bring the slide to the lowest point of the stroke for setting dies, while the wheel is in motion, and it is impossible to start the press by any accidental pressure upon the treadle. The lock is self-acting. A valuable feature of the machine is that the wheel can be turned backward to release a punch stuck in the die, or when fitting punches to the die.

Further particulars regarding these machines, which are now on exhibition at the New Orleans Exposition,

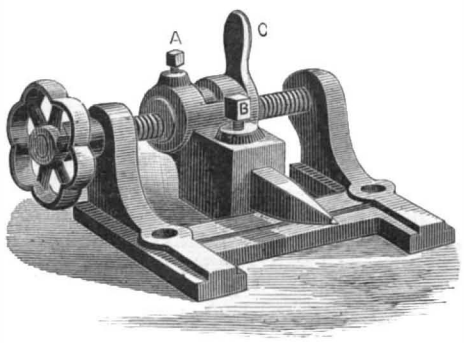


Fig. 3.

can be obtained by addressing the Stiles & Parker Press Co., of Middletown, Conn., or 59 Duane Street, New York city.

Electricity in Cotton Mills.

One of the most formidable foes we have to contend with in working cotton fiber is electricity, which is gene rated with fearful rapidity in dry frosty weather in all parts of a cotton mill, by the friction of machinery and belts. Suppose we look at the effect on a cotton breaker card on a dry November day, rather cool, with the wind ranging from north to northwest, when we find electricity very active and mischievous on cotton fiber. We may take a card in a very favorable place, by the side of a main belt, for the purpose of observing the effect on the condition of the fiber in the sliver, as compared to that of a card remotely situated from the main belt. If we select slivers of drawing from each, we shall find the fibers much better elongated in the sample from the card remote from the friction and consequent electricity of the main belt. Had we sufficient knowledge of electricity to measure it, we should find it in large quantities at the first point of much friction where the licker-in is combing the cotton from the feed rollers. It is quite evident, from the great variety of angles from a straight line in which we find the fibers in the slivers from the card near the main belt, that the card is charged sufficiently to attract the fibers from their straightened condition as they approach the doffer.

Standing in front of the card near the belt it is interesting to see the fleece between the doffer and the calender rollers raised up at intervals by the attractive power of electricity, and to notice the fibers drawn up out of line in their onward course to the rollers.

It is this silent force of electricity that is mischievous all the way through from the card to the small sliver between the rollers of the spinning frame. Frequently, when the air is dry and the electricity is active, heavily weighted drawing rollers are constantly catching up fibers from the slivers until they roll up and make bad work. Cotton fibers are very light, and when dry they are good conductors of electricity; when electrified or charged excessively, they are ready to fly to any point where there is the least friction. We may have some just conception of the fineness of cotton when we realize the fact, as found by actual count and careful weighing, that there are nearly 100,000,000 of low middling fibers to one pound avoirdupois, or more accurately stated 90,900,000.

By repeated trials in dry windy days I have removed the conducting wires from the counter and frame driving belts, and held slivers of roving 42 inches long, weighing about 3 grains, opposite a 2 inch belt, in which there was sufficient electricity to hold the sliver firmly in a horizontal position; by letting the rays of the sun in, near the belt, you can see streams of fibers flying in the air to load the belts with cotton.

For the purpose of finding the injury to the quality of the yarn, I recently selected a place where the power of electricity had been subdued by good insulated copper wire conductors, and I then carefully tested yarn from 10 spindles on the end of a spinning frame nearest the driving belt. The total average results of several trials only are given, to avoid lengthy columns of figures. With 59 to 65 per cent of moisture in the air during the experiments with the electricity taken away by the conducting wires, while the wires were removed I found the following results: With the conducting wires in position to work over the counter belt overhead and by the side of the frame belt, the average number of yarn was 28·48, the average strength 56·65 pounds, equal to 4·45 per cent above extra quality.

Using the same roving, and all other things being equal except the removal of the electric conducting wires, I found the average number of yarn the same as above, 28·48. The average strength, 54 pounds, equal to 1·52 per cent above extra quality, thus showing a depreciation of nearly 3 per cent in quality by the action of the electricity.

During an experiment on a former occasion, when there was but 53 per cent of moisture in the air, and the electricity was much more powerful, I found more than 4 per cent difference in quality. By mounting a good magnifying glass over the rollers at the end of the spinning frame, near the belts, the fibers were seen distinctly. By throwing rays of sunlight between the rollers with a good hand mirror, not only were the fibers seen drawn out at right angles from the surface of the sliver as it passed from the bobbin to the rollers, but the fibers between the rollers were seen constantly swinging off at every conceivable angle, giving the thread of warp yarn a rough woolly surface, much like mule filling spun from a low grade of cotton, in which a short staple of cotton predominated.

These facts show most conclusively the importance of placing all drawing, roving, and warp spinning machinery in the most favorable positions, away from the influences of electricity. The conditions of electricity are constantly varying. About one year ago I made several trials of the strength of yarn, similar to those given above, and found but little difference in the strength of the yarn. Extremes of moisture and heat combined, such as we have in New England in the month of August, will affect the working of cotton just the reverse of an extremely dry air when there is much uncontrolled electricity, causing the fibers to expand, increasing the size of laps from the lapping machinery and the lap heads, and all the slivers of drawing and roving. With 65 per cent of moisture in the air, and the temperature at about 75°, and with a northeast wind, the spinning and weaving in most of the New England mills will generally be found running well, provided the quality of the cotton and all other things are properly adapted to the numbers of the yarn spun.

Good electric conducting insulated wires to convey the currents to the ground are essential to success in controlling the silent, subtle fluid, and in this way to destroy the bad effects of electricity on the quality of the work in cotton mills, without the serious objections to the use of cold vapor or hot steam in the rooms. Care should be exercised, in conveying the electricity to the ground, to have an unbroken connection of metal to the ground, so that the current shall not be severed. If the conducting wires are attached to sprinkler pipes, care should be taken to file off any rust or paint, so that the connection shall be made with clean polished surfaces of the wire and pipe together.—*Textile Record.*

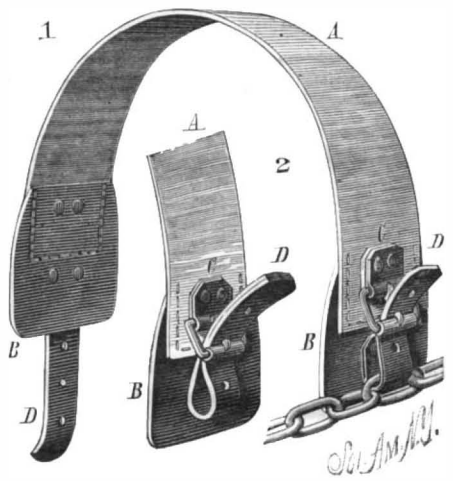
Carbon Disulphide Solution.

The solubility of carbon disulphide in water, and the uses of the solution, are attracting considerable attention just now. M. Peligot has made a communication upon the subject to the Academie des Sciences, by way of commentary upon the original memorandum of Ckiandi Bey. He recognized that pure carbon disulphide is soluble in water to the extent of 0·5 gramme per liter, if agitated in a flask completely filled with water. M. Pasteur has tested the solution in his laboratory, with a view to ascertaining its antiseptic properties, and the results have so far been most remarkable. It is declared to be possible that this solution will become the best antiseptic of the future, as it is already the cheapest. It costs only a few centimes per liter. M. Peligot finds that the solubility of carbon disulphide in water is much more than that already stated; and has succeeded in dissolving 3·5 cubic centimeters, or 4·52 grammes, in a liter of water at ordinary temperature—the density of the body being 1·293. This result was obtained by repeatedly shaking pure disulphide of carbon in a flask half full of distilled water; but it is the same with ordinary water.

The liquid thus prepared, even before the point of saturation has been attained, has a sugary smell, afterward burning. The odor, which remains for a long time when open to the air, resembles that of chloroform. Brought to the boiling point, it gives up the carbon disulphide; but this body is also driven off by sharp and prolonged ebullition. The water which condenses during this operation contains traces of sulphureted hydrogen, and discolors lead acetate. The solution before boiling does not affect the lead salt. The aqueous solution rapidly acquires a yellow color when placed in contact with potash, soda, or ammonia. If the solution is shaken with clear lime or baryta water, the liquor becomes yellow after some minutes, and throws down a white precipitate of carbonates of these bases, with simultaneous formation of sulphocarbonates. The barytes solution gives, by evaporation, carbonate and hyposulphite of baryta. The aqueous solution of carbon disulphide stops all fermentation, and is described as the insecticide *par excellence.* It is necessary to insist upon the purity of the substance, or the solution would have an insufferable odor.

BACK BAND.

The engraving shows a back band, patented by Mr. James B. McHugh, of Ambrosia, La., which not only secures greater comfort for the horse, but in which provision is made for changing the connection of the band from one part of the chains to another, and for lengthening or shortening the band and for putting it on without unfastening either end of the chains. The body, A, of the band is made of woven material, on



McHUGH'S BACK BAND.

each end of which is stitched a leather skirt, B, outside of which is a buckle holding strap, C. The fastening straps, D, are passed through any one of the links of the trace chains. It will be seen that this mode of attaching the band provides for putting it on without unfastening either end of the chains. In Fig. 1, one end of the strap is secured by rivets to the skirt, B; in Fig. 2 the strap is separate from the skirt, and is formed with perforations in each end; the method of attaching it to the buckle will be readily understood from the drawing.

Wild Flowers in Maine.

A forty mile stage ride through the more thinly settled portion of northwestern Maine, during the past summer, exhibited one botanical phenomenon of great interest and beauty.

As we were riding along the banks of the Canabassett River, a noisy little tributary of the Kennebec, our driver, hearing us speak of different flowers, said, "Just wait, and in a few miles I will show you the biggest flower garden that ever you saw."

Before long we came to a tract of some 4,000 acres, over which lumbering operations had been carried on some years ago, leaving a tangled mass of limbs and underbrush.

On June 8, of the present year, a fire broke out and swept over this entire tract, lasting for two weeks, and burning with such fury that it was almost impossible for the stage to travel along the road.

The driver said that the new vegetation began to start in three weeks after the fire, and as we drove along, August 14, our road passing through this tract for four miles, the whole region, as far as the eye could reach, over hill and valley, ridge and interval, was one mass of color from the "fireweed," *Epilobium angustifolium.* It looked, as one of the party said, as if the earth were covered four or five feet deep with a fall of pink snow. The sight was one never to be forgotten.

Now comes the query, "Where did the plants come from?" The region had been thoroughly burned over two months before, so that but little other vegetation had survived; the seeds are very light and feathery, and the driver had noticed none in the previous years. —*J. W. Chickering, Jr., Botanical Gazette.*

A Remedy for Frosty Windows.

A thin coat of pure glycerine applied to both sides of the glass will prevent any moisture forming thereon, and will stay until it collects so much dust that it cannot be seen through. Surveyors can use it to advantage on their instruments in foggy weather. In fact, it can be used anywhere to prevent moisture from forming on anything, and engineers will find it particularly useful in preventing the accumulation of steam as well as frost on their windows during the cold weather.

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Correspondence.

Estimating Distances.

To the Editor of the Scientific American:

The "Methods of Estimating Distances," which appeared in your issue of Dec. 6, seems to require a slight explanation. I gave, as I supposed, the correct formula heretofore used by me in estimating distances. Substantially it was the same as that which appeared in *La Nature* and in the SCIENTIFIC AMERICAN during July last, and should have read

$$x = \mathrm{H}\frac{l}{h}, \text{ where}$$

x = distance sought.
H = known diameter of distant object.
l = focal distance of the eye (10 inches).
h = micrometrical measurement of object.

Taking the examples given, they should have read as follows:

$x = 5{\cdot}5$ feet $\frac{10}{.0084} = 650$ feet.
$x = 2{\cdot}162$ (moon's diam.) $\frac{10}{.009} = 240{,}000$ miles.
$x = 850{,}000$ (sun's diam.) $\frac{10}{.00983} = 92{,}391{,}000$ miles.

G. R. C.

Head Downward.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of Nov. 29 is an article describing how Dr. Albert I. Garland, an English physician, restored a patient from syncope produced by chloroform, by inverting her, consciousness being restored as soon as she was placed head downward.

It was reported (perhaps in the SCIENTIFIC AMERICAN) more than a year ago that a French vivisectionist, who had put rabbits under the influence of chloroform, found them restored to consciousness as soon as he hung them against the wall, head downward.

H.

Frost Bitten Feet.

To the Editor of the Scientific American:

Your correspondent, T. B. E., No. 26, on page 330, Nov. 22, asks for a cure for frosted feet. About fifty years since mine were so bad that during warm days toward spring of year I was almost wild from the itching, but was completely cured by thoroughly rubbing them every night with a cloth dipped in alcohol, for about ten days; rub well in until the foot is dry, and then hold the foot as close to the fire as can be borne, for a minute or more. BURDOCK.

Westchester, N. Y., Dec. 6, 1884.

The Tehuantepec Ship Railway.

To the Editor of the Scientific American:

In your description of the ship railway project for crossing the Isthmus, SCIENTIFIC AMERICAN of December 27, you state that the idea was originated by Captain Eads; this is a mistake.

Dr. Wm. F. Channing, of Providence, R. I., proposed a ship railway for the Isthmus some thirty years ago, and in 1865 he secured a patent for transporting vessels on a multiple railway. His method included the ship car and cradle, tilting tables for overcoming grades, and turntables to effect changes in direction; and in May, 1871, James Brunlees, of London, England, submitted to the Honduras Government full details of a ship railway, together with drawings and estimates of cost.

Those wishing further information on this subject are referred to a report issued by the Bureau of Navigation, Washington, on the "Problem of Interoceanic Communication."

A. P. HOWARD.

Boston, Dec. 28, 1884.

[As we understand the matter, Captain Eads has never claimed that he was the first to suggest the idea of transporting vessels overland. In addition to the references suggested by our correspondent, he might refer back to very ancient times for examples, for instance, to the transportation of ships over the Isthmus of Corinth by the Athenians. Coming down to modern times, and to this country, it has been common for the past forty years or more to carry large loaded boats overland on railways. As to American plans for ship railways, one of the earliest, illustrated by engravings, is that given in the SCIENTIFIC AMERICAN of December 25, 1845—near forty years ago.

Captain Eads, we believe, is the first to present full, complete, and practical plans, approved by many distinguished engineers, for the easy and rapid lifting of large ships and safely transporting them by rail over the Isthmus of Tehuantepec. These plans exhibit a vast amount of study, and contain various features of striking originality and genius. Some of these points were illustrated in the series of ship railway engravings given in the SCIENTIFIC AMERICAN of December 27 last. Others may be found described in various patents which Captain Eads has taken out. If there is any one individual who has done more than Captain Eads to establish the fact of the practicability of taking ships over such places as the Isthmus of Florida and Tehuantepec, it ought to be made known, so that no injustice may be done.

Many able engineers believe that the Ship Railway will ere long be an accomplished fact, and then the world will wonder why it was that so many useless millions of money were wasted, and so many thousands of lives sacrificed, in the attempt to build a canal.—ED. S. A.]

Polishing Materials.

The following account of materials used for polishing is for the most part extracted from Holtzapffel's Turning and Mechanical Manipulation:

Buff Leather, glued to a flat surface, or to the edge of a revolving disk, is used with emery, crocus, rottenstone, and other powders.

Charcoal is much used by steel and copper plate engravers. That made by burning elder without access of air is considered the best, but willow and elm have also been recommended.

Diamond, in the form of powder, is used by lapidaries and engravers and watch jewel makers. The latter obtain the diamond *bort* that is rubbed off stones in faceting, and they separate it into various degrees of fineness by decantation.

Diamantine, sapphirine, rubitine, etc., are names given to various chemical preparations for polishing, to be obtained at the tool shops. They must not be assumed to consist in any way of the jewels from which their names are derived.

Emery.—At the present day oilstone dust is very frequently replaced by emery with oil or water, especially in clockwork. Any required degree of fineness can be obtained by decantation. Emery dust is sometimes used in place of rouge for polishing. The solid emery wheels and sticks, that are now common to the trade, work rapidly, but they have the disadvantage of heating steel, and many of them soon become pasty. The heating renders them less suitable for grinding gravers, but they are very convenient for roughly shaping steel work, or removing the hard surface caused by the application of heat.

To Make Emery Paper.—If occasion requires it, this can be done as follows: Fix a sheet of stout blotting paper on a board, gluing it round the edge. Having put emery powder into a sifter the mesh of which has the requisite degree of fineness, and rapidly covered the paper with thin hot glue, shake the sifter lightly over the paper until it is evenly covered, and leave to cool. When dry, detach the paper and shake it vigorously to detach loose grains.

Hone Slates.—Under this heading are included a great variety of stones used for smoothing and polishing.

Blue Polishing Stone is much used by jewelers, clockmakers, and others. It is recommended for use in spotting and for polishing wheels.

Oilstone.—This forms the quickest cutting whetstone known. Oilstone slips are used by watchmakers after the manner of files. Oilstone powder or dust is much used in the earlier stages of polishing, and is preferable to emery in that it does not leave particles embedded in the surface of the metal. On pewter laps it may also be employed for polishing steel work.

Oxides of Iron.—Under this head are included the several materials known as crocus, rouge, red stuff, colcothar of vitriol, etc. It is advisable to remove gritty particles from these materials before using, by decantation.

Pumice Stone is extensively used for polishing cut glass, and is applicable to brass and other metal work.

Putty Powder is oxide of tin, or more commonly, of tin and lead in varying proportions. The whitest kind, provided it be heavy, is considered the best.

Rottenstone.—This variety of tripoli is of the greatest value for polishing brass work, silver, glass, and even the hardest stones.

Tripoli is of a grayish yellow or red color, and consists mainly of silica. Its principal use is in the polishing of hard woods.

Whiting is common chalk ground, washed to remove sand, etc., and dried in lumps.

Polishing Stones.—The following method is described by M. Cadot for preparing these stones, which are very useful for polishing a wheel that is not riveted to its pinion. Carefully select a blue stone. After dressing its surface, smooth it with emery paper of gradually increasing fineness. Saturate the surface with oil, and rub it with a common piece of rough sapphire, one face of which is flat and partly smoothed, until the surface of the stone is hardened.

Such a stone is used dry. The wheels must previously have been carefully smoothed, since the stone does not abrade the metal. If care is taken to avoid scratches, the surface will last for a long time, although, of course, it is only serviceable for gold, brass, nickel, or metals of a similar degree of hardness.

The several materials used for polishing must be kept carefully packed (glass stoppered bottles are preferable), as a few grains of dust or foreign bodies will suffice to prevent the operation of polishing from being successful. Polishers should be filed very smooth with a perfectly clean file that is not quite new. Files that are dirty or new will deposit small hard particles of dirt, or cause pieces of the points of their teeth to become embedded in the surface of the polisher.

PREPARATION OF POLISHING MATERIALS.

Decantation.—This consists in causing a material in a fine state of subdivision to fall slowly through a liquid with the view to separate particles of various degrees of fineness by taking advantage of their different rates of descent.

The watchmaker should prepare all his smoothing and polishing materials, etc., by decantation. He will by this means obtain them in grains that are much more uniform in size, of any degree of fineness, and free from hard or large particles.

The operation is exceedingly simple. The material having been pounded under a hammer or otherwise, is thrown into a vessel more or less filled with a liquid —water, oil, etc. After being thoroughly stirred, it is allowed to partially settle, and the liquid is carefully poured into another vessel. All the coarse heavy grains will be found as a residue in the first vessel. They are collected and used for coarse work. After again stirring and leaving to settle for a longer period, the liquor is again poured off, and the powder thus separated will be the second degree of fineness, so that it may be termed No. 2. By successive operations in which a gradually increasing interval of time is allowed, Nos. 3, 4, etc., can be obtained, that is to say, a series of powders of the same material, but presenting a greater degree of uniformity in the size of grains and of gradually increasing fineness. It may be observed that when the powder of the requisite degree of fineness is nearly attained the mass should be left to settle until the following day, or rather until the fluid is clear; then decant carefully, so as not to lose any of the deposit.

When treating a material that is soft and friable, it should be crushed between the fingers, as by using a hammer hard grains of foreign matter might be accidentally intermixed.

Oil may be used for decanting diamond powder or oilstone dust for smoothing; water for rottenstone or tripoli; alcohol for hartshorn, etc.

Swiss Watches for the American Market.

United States Consul Gifford, of Basle, writes that for the fiscal year ended June 30 last there has been a net decrease of exports of $740,612.72, or nearly 15 per cent as compared with the preceding year. This decrease is chiefly attributable to the diminished exportation of watches and watch materials from the consular agency of Chaux de Fonds, which was $500,000 less than during the preceding year. That this branch of exportation will continue to decline in consequence of the rapid development of the corresponding industry in the United States, until it ceases altogether, cannot be assumed with entire confidence. As is well known, the Swiss have once recovered their lost ground in this direction. Having seen their American market almost escape them after the Centennial Exhibition of 1876, they were able, by the employment of the greatest energy, perseverance, and skill, to regain what they had lost, and even to increase their export of watches to a point never before reached. In 1882 this amount was $2,268,731.79 in this district alone.

This point may never be reached again, but the Swiss will not surrender their American market without a renewed struggle. They will in this be seconded by many circumstances which are favorable to their supremacy in this branch of production. The principal advantage is the low rate of wages which must be accepted by men occupying the sterile valleys of the Jura, where agriculture is impossible, and where they have been from their childhood devoted to this one calling. They must make watches; if not for good wages, then for poor wages.

It might be supposed that only the higher priced merchandise and timepieces of special construction and extraordinary precision could now find a sale in the United States, considering the immense numbers of low priced articles produced by our manufacturers. But such is not the case. Very large shipments of so-called watches, invoiced as low as 10 francs each, and even lower, still go forward. A suspicion of gross undervaluation naturally arose under these circumstances; but a personal investigation and examination of the books and original accounts of manufacturers led to the conclusion that watches can be, and are, produced at these seemingly impossible prices.

The Spanish Earthquakes.

Commencing on December 25, a series of earthquake shocks was felt during several days over a considerable portion of Spain, which were attended with great loss of life and destruction of property in the southeastern provinces of Granada and Malaga. The inhabitants in many cases fled from their houses and camped in the fields. In the province of Granada over 900 lives were lost, and in the town of Alhama, in that province, fourteen hundred houses were destroyed. In many other towns houses were thrown down and walls cracked, with more or less loss of life. The shocks continued intermittently for ten days, the people being greatly terrified, and resorting to prayers, religious processions, and Te Deums throughout most of Andalusia.

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NEW ROADWAY BRIDGE.

The new roadway bridge over the river Ouse at Bedford, illustrations of which we give, has been now completed and, amid great rejoicings, formally opened. The bridge consists of one central span and two smaller side spans, the distance between the faces of the north and south abutments being 200 ft. The arches are segmental, and consist of four central wrought iron ribs, spaced 5 ft. apart, to carry the vehicular traffic, and two outer ribs to carry the parapet and passenger traffic. The main ribs of the central span are made of 4 angle irons 4 in. by 4 in. by $\frac{11}{16}$ in. and two web plates $\frac{11}{16}$ in. thick; the horizontal member consists of two angle irons 6 in. by 4 in. by ½ in., with braced spandrels of channel iron 5 in. by 4½ in. by 23 lb. The other ribs are of the same construction, with the thicknesses reduced in proportion. All the ribs are well braced laterally with angle iron 3 in. by 3 in. by ½ in., and rest upon strong cast iron skewbacks let into the Bramley Fall springings. The outer ribs are fitted with ornamental cast iron spandrels and cornice, as shown in our illustration, and surmounted with a handsome parapet railing. The flooring of the bridge is made of Westwood and Baillie's corrugated plates 6¼ in. deep, and covered with asphalt and concrete, on which is laid the macadam. The clear width between the inside of parapet railing is 35 ft., with footways 7 ft. wide.

The foundations have been taken down to the rock, which lies about 12 ft. below the surface. The piers and abutments are made of Portland cement concrete, in the proportion of from 7 to 10 to 1, according to the position, and are faced with 14 in. and 9 in. brickwork up to the springings, and above with Darley Dale stone from Mr. Boden's quarry, the pilasters of the piers and abutments being entirely of this stone. Ornamental cast iron lamps are fixed to the cap of each of the pilasters. The bridge is approached on the north side by a new road, with a gradient of 1 in 87, having slopes of 1½ to 1, and fenced with Baltic red wood posts 9 ft. apart, with three angle iron rails. The approach on the south side has a gradient of only 1 in 127, and has a close wooden fence on one side 5 ft. 9 in. high, and a paneled brick wall on the other, on the top of the retaining wall. This retaining wall, which is about 15 ft. high at the abutments, is built of cement concrete 10 to 1, faced with white brickwork 14 in. and 9 in. thick, having a batter of 1 in 12, and was necessary on account of the contiguous property.

The works have been designed by Mr. John J. Webster, Assoc. M. Inst. C. E., of Stephenson Chambers, Liverpool, who also superintended the construction and erection. The contractors for the masonry, brickwork, and concrete, etc., were Messrs. S. W. Pilling & Co., of Manchester and Bolton; and for the ironwork, Messrs. Goddard and Massey, of Nottingham; and great credit is due to them for the excellent manner in which they have completed their contracts. The whole cost of the works, exclusive of the purchase of land, has been about £8,000; which must be gratifying to the engineer, as it is within his original estimate. This cost is extremely low, and considering the amount of labor necessary for such a class of bridge in comparison with the weight, it will be found to compare most favorably with any existing structure, either at the rate per ton or per superficial foot of space covered. The north approach is 530 ft. long, and the south one 576 ft., and 40 ft. wide, having footways 8 ft. wide paved with York 3 in. tooled flagging, and the roadway of macadam. The river Ouse has also been very much improved near the bridge, from plans prepared by Mr. Webster.—*The Engineer.*

ROAD BRIDGE OVER THE OUSE AT BEDFORD.

STEAM BELL FOR LOCOMOTIVES.

The secondary railways of the rural districts of Austria have neither gates nor guards at crossings, and are as open as tramways. It is therefore necessary to take special precautions to prevent accidents and give warning of the approach of a train at a sufficient distance from the crossing. For this purpose preference is given to bells rather than to whistles, as the latter have the inconvenience of frightening horses. The annexed figure shows the arrangement of the steam bell adopted upon Austrian locomotives. It is of the simplest construction possible. It consists of a cylindrical cast iron reservoir, A, slightly tapering at its upper part and closed by a valve, B, upon which is fixed, at the end of a lever, a hammer, D, which strikes the bell, C. The steam enters through a small lateral tube situated at the lower part of the reservoir. As the aperture to which the valve, B, is applied has a much larger diameter than the steam tube, it results that the steam escapes from the cylinder more rapidly than it enters. Every time the valve opens, the pressure lowers and causes it to fall back, and the hammer is thus made to strike the bell. The valve is provided internally with a collar that allows it to travel a certain distance before the steam can escape, and to thus regulate the fall of the clack and the density of the blow. The latter is still further increased by means of a spring which prolongs the lever, and acts at every rise of the valve in such a way as to accelerate the fall. The starting and stoppage are effected by the simple maneuver of a cock; but since a certain condensation occurs in the cylinder, A, every time the bell is rung, this cock is so arranged that in a position of rest it shall establish a communication of the cylinder, A, with the exterior, through a small aperture, and thus allow all the water of condensation to flow out.

LOCOMOTIVE STEAM BELL.

Upon varying the pressure and the aperture of the cock, the number of blows per minute may be made to vary between 130 and 240.—*La Nature.*

Automatic Arctic Exploration.

The Chicago *Current* says: Probably the most wonderful thing in connection with the whole sad history of Arctic exploration is the recent discovery of an ice-floe in the waters of Davis' Strait—west of Greenland—which had drifted from a point in the Arctic Ocean northeast of the Lena delta—where the crew of the Jeannette divided into three parties and took to the open waters—to the southernmost point of Greenland, and north again to Baffin's Bay. Upon this floe were a corpse and many indubitable relics of the expedition, including an article of wearing apparel marked with the name of seaman Noros, who, it will be remembered, in company with seaman Nindermann went a few miles ahead of poor De Long, and lived to write the most extraordinary experience ever penned by a human hand. Had these two simple seamen been able to tell, in the Siberian tongue, that their comrades were only eleven miles back, the whole De Long party would have lived to join Melville and Danenhower.

Now, the floe discovered by the Greenlanders has, perhaps, crossed directly over the North Pole. From the Jeannette floe to the southern point of Greenland, in a direct line across the Pole, is 3,500 miles, but by way of the northern shore of Asia and Europe—past Cape Northeast, Nova Zembla, Spitzbergen, and Iceland, and north again into Baffin's Bay—would be a distance of at least 6,000 miles. Scientifically, the life of a moving ice-floe for so many years, and its migration from one side of the world to the other, ought to furnish suggestions and data more valuable than all the other fruits of polar research combined. Self-registering meteorological apparatus, and possibly gauges of the miles traveled, may in the future reveal to the investigators what the sacrifice of thousands of lives has otherwise failed to discover.

A Waterproof Varnish for Paper.

One part dammar resin and six parts acetone are digested in a closed flask for two weeks, and the clear solution poured off. To this four parts of collodion are added, and the whole is allowed to clear by standing.

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A STUDY OF THE NAVIES OF ANTIQUITY.

When we study the history of the first Punic war, and endeavor to get an idea of the maritime operations that had so great an influence upon the result of the contest, we are struck by the want of accordance that is revealed upon every page between the elements of the drama whose phases we are following. The ports contain no fleets; the days are not long enough for the maneuvers described; the effective material is out of all proportion to the population of the two republics; and the power of production of the dockyards that had scarcely been created exceeds that of all the arsenals of Europe combined.

Historical criticism is powerless to explain such contradictions or to rectify such errors. A single version exists, which is repeated by old writers with few variations, and which has been accepted by modern writers with a unanimity that proves an identity of origin much more than a faithfulness of the narratives.

Technical criticism puts us into a dilemma. Either we must believe that the Romans were supernatural beings—a fact that would add nothing to their glory—or else Polybius has not wished to deny those too flattering traditions of a people whose involuntary guest he was, and whom he passionately admired.

If, after establishing the error, we seek the cause of it, if we accept all that is plausible and throw out only the contradictory facts, if we reduce to a minimum the doubt that it is necessary to undergo and the negatives to which we are inevitably led, we find that the entire difficulty is summed up in a single question, and one that belongs to the domain of naval archæology.

Is it or is it not true that the quinqueremes constructed by the Romans when they undertook to create a navy, were ships that carried a crew of from 400 to 500 men, that displaced 500 tons, and that were analogous to those Greek penteconters which we have seen figuring at the battle of Chio? As regards this, Polybius is explicit, and it is necessary either to discuss his competence or to believe with Enneus Florus in the intervention of the gods.

When we undertake to restore the galleys that were victorious at Myle and Ecnomos, we find no positive documents that permit of bringing the Athenian trireme to life again, and at the same time the types that preceded and followed it. We know that the first Roman galleys were imitations of those of the Carthaginians, a nation of merchants, who lorded it over the entire west basin of the Mediterranean; we know that they were constructed and armed in immense numbers, in a very short time, by a people who possessed no dockyards, no tools, and no supplies; we know about their navigation and their prowess; and we can still study the configuration of the shores where the fleets were hauled up on land without preparations.

This is enough, in proceeding by exclusion, to establish the general characters of the vessels which figured in the first Punic war. In uniting such characters by an estimate and a sketch, we get the boat shown in Fig. 1—a decked bark 65 feet in length, of 45 tons displacement, and having a normal crew of 70 men. Its propelling apparatus consists of five large oars on each side. It is a construction which recalls at one and the same time the Spanish balancelle, the Ligurian tartan, and that heraldic galley which painters and sculptors have undoubtedly borrowed from some tradition of remote times. Without desiring to enter into details that would be out of place, without pretending to an accuracy that the subject does not admit of, I shall compare this quinquereme with the penteconter of 300 rowers described by Polybius, and I shall set them opposite each other in a narrative given by that author himself. It is one of the clearest and most interesting of his history.

The Battle of Drepana.—The Romans had been laying siege to Lilybæum (Marsala) for more than a year. Drepana (Trapani) and Lilybæum were the only ports that remained to the Carthaginians in Sicily. They held possession of the last named city because nature had endowed it with an excellent port, easy to defend, and very well arranged for the use of the galleys. Hannibal, the son of Hamilcar, had been sent to succor the place, and many deadly fights had taken place between the two armies. The besieged had several times vainly attempted to destroy the engines of the besiegers, when one day there arose a violent tempest that favored their designs. They made a sortie, and, after a bloody combat, in which the Roman army met with great losses,

Fig. 3.—ORDER OF BATTLE OF THE ROMAN AND CARTHAGINIAN FLEETS. (A. Carthaginian Galleys. C. Roman Galleys.)

the works were overturned and the engines burned, so that the walls of Lilybæum could be rebuilt.

Polybius says (Lib. I.): "When it was learned at Rome that the greater part of the crew belonging to the fleet had perished, either in the defense of the engines of war or in the operations of the siege, a draft of sailors was quickly made, and ten thousand sent to Sicily.

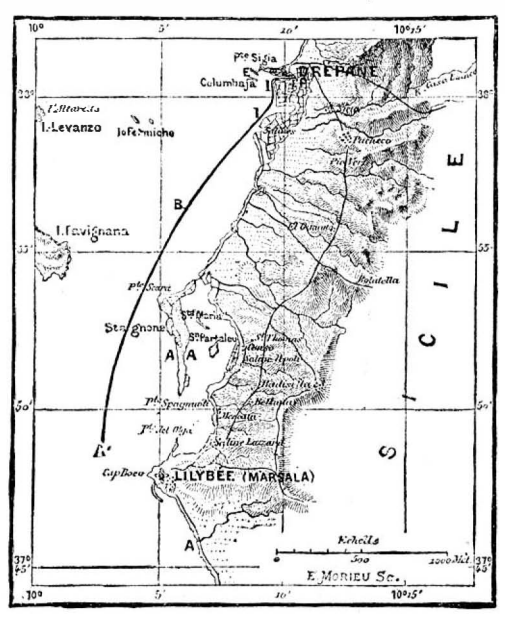

Fig. 2.—MAP OF SICILY.

They traversed the strait and reached camp by land. As soon as they had arrived, Consul Publius Claudius called the tribunes together, and told them that the occasion was favorable for attacking Drepana with the entire fleet; that Adherbal, general of the Carthaginians, to whom was confided the defense of that city, must think himself secure against such an undertaking; and that, not knowing that the Romans had received re-enforcements, he doubtless believed them incapable, after the losses that they had undergone, of setting out with their vessels. The tribunes shared the opinion of the Consul, and so the galleys were manned with the old and new crews, and volunteers, taken from among the best soldiers of the army, being seduced by hopes of rich booty after a short sail, embarked along with the rest.

"All being thus arranged, the Roman fleet set sail at midnight, unbeknown to the Carthaginians, and followed the shore in silence, leaving land to the right. At daybreak the galleys of the vanguard were perceived from Deprana. Adherbal, very much surprised at their arrival, but at once comprehending the designs of the Consul, resolved to risk everything rather than allow the city to be besieged. He therefore hastily assembled the sailors upon the shore, and sent heralds to all quarters in order to convoke the mercenaries. As soon as all had assembled, he gave them to understand, in a few words, that if they desired to fight they could count on a victory, while that if they shrank before the present danger they would expose themselves to all the miseries of a siege. As they all showed themselves to be full of ardor, and asked to be led to the enemy, Adherbal congratulated them and ordered them to embark and follow his galley. He at once set sail, and led his fleet under the rocks that skirted the entrance to the port on the side opposite that by which the Romans were beginning to enter.

"Consul Publius, seeing that the Carthaginians, contrary to his expectations, were neither surprised nor frightened at his arrival, and that they were disposed to fight, gave orders to his galleys (some of which were already in the port, and others on their way thither) to put about, and make for the open sea. It resulted that between those that had crossed the pass and those that had reached it there was great confusion, followed not only by disorder among the crews, but also damage to the oars. Meanwhile the captains, in measure as the vessels became extricated, had them put into a line along the shore, with the rostrum toward the enemy. Publius, in his order of sailing, had placed himself in the last row, and it followed that, according to the formation that he had planned, he was at the extremity of the left wing.

"Adherbal, having taken five swift galleys, flanked the left of the Roman army, and then arranged his galleys in a line fronting the open sea. At the same time he sent orders to all the vessels that followed him to imitate his maneuvers. As soon as his whole fleet was thus formed, he gave the signal to advance against the enemy (Figs. 2 and 3). During this time the Romans remained along the shore awaiting the sortie of their last galleys from the port. From this it resulted that the Roman fleet, being inclosed between the enemy and the coast, fought at a great disadvantage.

"As soon as the two lines had drawn near one another, the prætorian galleys hoisted their flags, and the fight began. In the beginning the contest was nearly equal between the soldiers, who were the picked men of the two armies; but since the Carthaginians soon occupied a better position, the advantage began to turn in their favor. They excelled in quickness and in ease of evolution, because of the lightness of their keels and of the experience and skillfulness of their oarsmen. Having formed their line of battle toward the open sea, such galleys as became too closely pressed could easily retire to the rear of the line, because of their speed; while the Roman galleys, when they darted forward in pursuit of an adversary, and it afterward became necessary to fall back in order to avoid the oblique attacks of the enemy who surrounded them, turned sidewise, and in this position, heavy and badly maneuvered, received shocks that ended in sinking them. A large number was destroyed in this way. With the Carthaginians it was entirely otherwise: if one of their vessels was in danger, one of its neighbors came to its aid and towed it toward the open sea. As for the Romans, they were fighting too near land to move back, and when a galley was loaded in front and pushed by the prow, it stranded astern or broke on the reefs of the coast. The Romans could not attempt passages through the line, or an attack after an inversion of the ships that were already

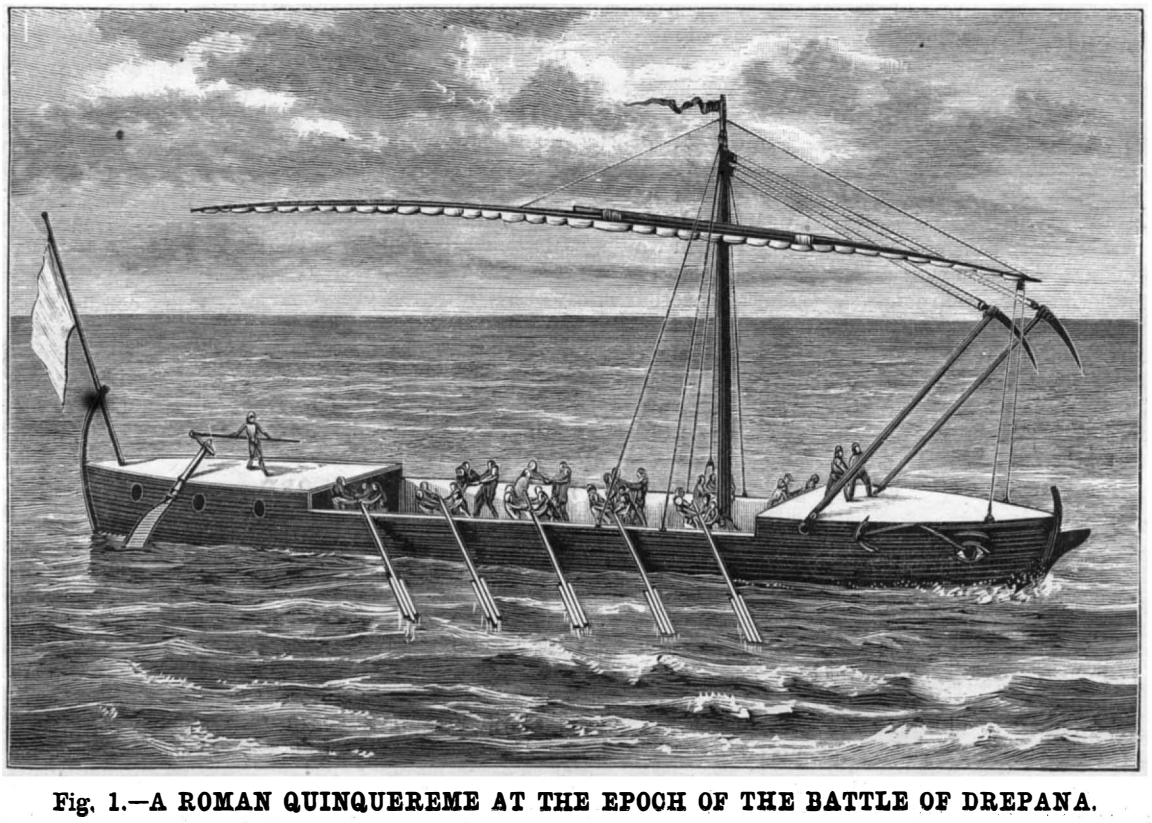

Fig. 1.—A ROMAN QUINQUEREME AT THE EPOCH OF THE BATTLE OF DREPANA.

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engaged (maneuvers that are so important and efficacious), because of the heaviness of their keels and want of skill of their oarsmen; neither could they extend aid to those who were closely pressed, by crossing them astern, seeing that they were too near shore and that there was no room between them and land.

"The Consul, seeing that the battle was lost, and the majority of his galleys were stranded on the coast, escaped with thirty vessels of his left wing in keeping close to the shore. The Carthaginians took all the rest, ninety-three in number, with their crews, only a few men from which escaped by jumping ashore after the stranding of their vessels."

The foregoing narrative may be summed up as follows:

The Romans having suffered such losses that it was impossible for them either to continue the siege of Lilybæum or to menace Drepana, ceased all aggressive operations, and drew their quinqueremes ashore in the vicinity of their camps, A A (Fig. 2), so that they were unexposed to bad weather and the enterprises of Adherbal. In this situation Claudius received a re-enforcement of 10,000 men. Out of this number, raised in haste, we may suppose that 6,000 were ready to embark upon their arrival. To this 6,000 he added 3,000 sailors belonging to the old crews and 3,000 picked soldiers, and with this 12,000 men made up his armament of 123 galleys, which thus had complete crews and supplementary soldiers. At the approach of night he put his fleet upon the sea, and at one o'clock in the morning set out from the point, A', hugging the shore and sailing slowly. His vessels, according to the custom of the times, were formed into a file by platoons. As the latter consisted of four galleys, and the interval between them was 262 feet (the minimum distance that permitted the file to pass to a line of battle), the length of the column was 9,184 feet, or about a mile and three-fifths.

At five o'clock in the morning, the speed being two knots per hour, the vanguard was at B, five miles from Drepana, and at this moment was sighted by the Carthaginians. Adherbal at once took his measures; he collected the crews, launched such of his galleys as had been hauled up to dry, and called together the mercenaries that were scattered throughout the city. At seven o'clock he set sail, ran by the walls of the city, and steered toward Columbaja, E, a rocky island that covers the entrance to the port. During this time the Roman galleys had increased their speed, and at seven o'clock the vanguard entered the port, P, leaving the island, I (Fig. 2), to the left. P. Claudius, who was in the rear guard, saw the movement of Adherbal's fleet, and, comprehending its import, ordered his galleys to put about, and tried to arrange them in line of battle. The combat took place along the line, I I (Fig. 2), under conditions and with results that we have seen.

All these facts in their entirety hold together admirably, and their probability is perfect on condition that the quinqueremes of both fleets in no wise resembled those of which Polybius (in his chapter on the battle of Ecnomos) has given the equipment. In fact, if each quinquereme had been provided with 500 men, the Consul could not have manned the 123 with less than 60,000 sailors and soldiers, inclusive of the volunteers. The 10,000 recruits derived from Rome would have been but a small complement, and Adherbal would not have dwelt in the confidence that P. Claudius supposed. On another hand, if quinqueremes of such dimensions had been hauled ashore, he could not have launched them without preparations and unbeknown to the Carthaginians. As for these latter, who, according to the Greek historian, were of the same strength as the Romans, it is clear that they could not, in two hours, have put 50,000 men into galleys which, even supposing them afloat, could not be manned rapidly, inasmuch as their draught was such that they could not be reached without the aid of row-boats. In whatever way we look at the operation against Drepana, all is easy and simple if we suppose the quinqueremes to have been barks; but all is impossible if they were large ships.

A comparison of the circumstances attending the battle of Chio with those of the battle of Drepana renders these conclusions still more obvious. At Chio we see old navies—fleets created by secular industries—in combat. If the cataphracts of Attalus, of Philip, and of Rhodes were barks, the narrative of Polybius has no longer any sense. At Drepana, on the contrary, as at Myle and Ecnomos, we find multitudes whose construction, movements, and enterprise are only comprehensible on the supposition that the unity was small.

There remains one difficulty. Polybius says (and no one challenges his testimony) that the Romans made their debut in naval construction with penteconters carrying 300 rowers and 120 soldiers, and that they built and armed 220 of these in three months, and that the battlefield of Ecnomos saw 700 galleys and 300,000 combatants. Are we obliged to believe this? Is a great historian by rights infallible? For my part, I think there are errors that must be fought, whatever be the name by which they are signed. In order to admire, it is necessary to understand, and great examples are useful to those only who believe in the possibility of following them.—*Rear Admiral Serre, in La Nature.*

Exhibition of American Goods in Chili.

In these days of overproduction and high tariff, when our manufacturers are surrounded, as it were, with a high wall which effectually prevents their leaving the country, it is gratifying to know that there exist nations, at least on the Spanish Main, that have confidence in our ability to compete with Europe in an open market. In a circular which lies before us, American manufacturers are cordially invited to exhibit their wares at a Permanent Exhibition of American Manufactures and Machinery soon to be opened at Santiago, Chili.

Speaking of the Chilian market, the circular says: "There are two obstacles which have hitherto prevented the development of our trade with Chili—one is our own high tariff, and the other is the lack of exact information in Chili as to the character and cost of our manufactures and machinery." It goes on to express surprise that of the $34,000,000 annual Chilian imports, the United States should have contributed only $2,000,000, one-half of which is represented by petroleum and lumber. Yet it is not so very surprising, nor are the causes which have led to the decline of our trade with Chili far to seek. Aside from tariff difficulties, which it is not the purpose of this article to discuss, there are other difficulties which make introduction of American goods difficult.

There is hardly a town in South America where European merchants are not to be found. These deal in European fabrics and manufactures from choice, and could hardly be expected to assist in demonstrating the excellence of American goods. As a result, the natives know little or nothing of them, and it is with a view of presenting them to their attention that the exhibition at Santiago is to be established.

There is a good reason to believe that a large quantity of American goods could even now find a market in Chili and other South American countries, if only their excellence could be demonstrated on the ground. It will interest the manufacturer to know that there is at present a large and greatly increased demand in Chili for cotton manufactures, agricultural and mining machinery, rolling stock, all kinds of hardware, furniture, scientific apparatus, canvas, and naval stores.

Americans have made great efforts in Mexico, and expended many millions in building railroads, yet the Chilian trade is almost twice as large as the Mexican.

Only a little over thirty years ago we had 25 per cent of the Chilian trade, but now only 4 per cent. Chili together with the whole South and Central American coast is a natural outlet for our products, and it is gratifying to see projects like this Permanent Exhibition of American Manufactures and Machinery set afloat with the commendable purpose of introducing American goods in a strange market.

Nickel on Zinc.

According to a process for nickelplating zinc, described in the *Journal of the Society of Chemical Industry*, the zinc is cleaned by dilute hydrochloric acid and thoroughly washed. It is then hung in the nickel bath for a short time, and on taking out is rinsed and thoroughly scraped, so removing all that does not adhere firmly. This is repeated till the zinc is covered with a thin film of nickel, which can afterward be made as thick as required. The suitable current strength is easily found. When the zinc is once thoroughly covered, the current may be increased without any risk of peeling off.

Friction.

M. Hirn communicates to the Academie des Sciences some observations on friction, with particular reference to machines and motors. He has arrived at the conclusion that there is a great difference between the friction of two surfaces sliding one upon the other, according as they are dry or separated by a layer of lubricating material. In the case of what he calls the *immediate* friction of bodies (*i. e.*, those surfaces which are dry), the coefficient of friction is independent of velocities, areas, or load. It is otherwise with the other order of sliding bodies, in which, as is generally the case, the surfaces are separated by an unctuous layer. Here the coefficient of friction is always a function of the velocity, the load, and the extent of the sliding surfaces. It is difficult to arrive at the exact laws which regulate the phenomena. The quantity of lubricant drawn under the rubbing surfaces by their movement, the temperature of the lubricant, etc., are capable of modifying the value of the coefficient of friction many times in the course of a single experiment.

It may be broadly stated that, in the general condition of ordinary machines, the power necessary to overcome friction is proportional to the square roots of the sliding surfaces and of the load, and (when the lubrication is abundant) to the velocity. The influence of velocity is above all complex. With great velocities, or at least when the loads are light in comparison with the frictional surfaces, a great number of liquids very different from oils or fats become lubricants. Air, under certain conditions, and when brought in sufficient quantity between the sliding surfaces, becomes the best of lubricants; the coefficient of friction being thereby reduced to one ten-thousandth. When, on the contrary, the speed is too low, or the load relatively too heavy, the unctuous matter may be expelled. The friction then becomes immediate, with a coefficient rising to one one-hundredth or one-fifth. M. Hirn points out that these views are supported by some observations of M. Deprez, who found that the coefficient of friction of a given machine, determined for a certain velocity and state of lubrication, diminished as the speed increased and the oil became warm; while, when the velocity was much diminished, the lubricant was no longer drawn between the surfaces in sufficient quantity, and the contact became as metal to metal.

Electric Lights for Private Dwellings.

Perhaps the most perfect method of utilizing electricity for household purposes is the installation recently put in at the residence of Mr. E. H. Johnson, in this city, President of the "Edison Company for Isolated Lighting." Arranged in one corner of the house cellar is a 30 horse power engine running noiselessly at a speed of 290 revolutions per minute, connected by an 8 inch belt with an Edison dynamo of sufficient capacity to illuminate three city dwelling houses from top to bottom.

Wires lead from this machine to the various rooms of Mr. Johnson's house. Each floor is provided with a separate set of wires, safety plugs, and switches, and any chandelier or part of a chandelier may be instantly lighted or extinguished at pleasure. The exhaust steam of the engine is utilized to heat radiators in the cellar inclosed in air boxes, and heat the cold air, causing it to ascend the original hot air flues built in the house.

The condensed water from the radiators is returned to the boiler by a pump. When in full motion, the engine makes no noise that can be heard above the cellar. In the cellar the only sound was that of a slight flapping of the belt upon the engine pulley, and this Mr. Johnson expects to eliminate by the employment of a rope belt.

Fixed in one corner of a billiard room in the basement was an Edison automatic circuit regulator, consisting of a device for automatically switching in or out more or less resistance coils to balance a few or large number of lamps. It was extremely sensitive, and operated rapidly. From the regulator two main wires ascend through the house with branches at each floor. Fireplaces in the different rooms were illuminated by a series of incandescent lamps, covered with small pieces of pink and red tissue paper, the appearance of which at a short distance closely resembled a glowing coal grate fire.

The advantage the light possesses of illuminating pictures was shown by suspending a lamp in the interior of a large painted porcelain vase; the picture stood out in fine relief. It has been found that colored glass globes for incandescent lights retain an increased amount of heat, and that a softer and more diffused colored light can be obtained by stretching over the glass a piece of colored tissue paper or silk fabric. The lamps in theaters are modulated in this way; the changes of colored lights on the stage being effected instantly, and with as much facility as with gas.

To illustrate some of the advantages of having an abundance of electricity in one's home, Mr. Johnson devised a method of illuminating at intervals a Christmas tree with myriads of different colored lamps. He had made specially a large number of small incandescent lamps of 3 candle power each, covered with different colored silk bags; these were strung in vertical rows from the bottom to the top of the tree, a series of 4 rows being connected to one conducting copper plate embedded horizontally in the bottom portion of the trunk of the tree. The upper ends of the series were connected to the opposite wire. There were six conducting copper plates on the trunk of the tree, three being arranged to be connected with one pole of the dynamo; the other three with opposite pole. The same current which produced the light also propelled a small motor geared with cog wheels, and located under the platform.

When the switch was turned on, the motor revolved the tree noiselessly and at a slow, uniform speed; at the same time connection was alternately made with the conducting plates on the tree trunk, thereby causing the miniature colored lamps over the surface of the tree to become alternately lighted and extinguished, from twenty to forty at a time. The constant changing of colored lights, combined with the rotary motion of the tree, produced a very novel and beautiful effect, which was enhanced as one saw it reflected in an adjacent mirror.

The quietness which prevailed throughout the house was of itself a surprise to many when told that a 30 horse power engine was running at a high speed in the basement; and it proved conclusively that a decided advance has been lately made in isolated electric lighting.

OYSTERS are reported to be good for dyspeptics. They never produce indigestion, and are preferred by invalids when all other food disagrees with them. Raw oysters are used by singers for hoarseness.

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The Identification of Minerals.*

A person's first thought on picking up some unknown mineral or rock from the roadside, the quarry, or the field, is, What is this? What is the name of this object? and, if he has no more knowledge of the mineral world than the majority of people, he will be unable to answer his query, unless the specimen should chance to be quartz, mica, or some such very common mineral.

After the student of mineralogy has advanced far enough in his studies to become somewhat familiar with the subject, he begins to ask himself, when examining some fragment of the mineral kingdom, Of what is this object made? What is its composition? and lastly occurs the question, How was it made? This article concerns itself only with the first of these three questions. It is well, perhaps, to say here that, in order to acquire a knowledge of the physical peculiarities of minerals sufficient for their identification, the student should familiarize himself, by frequent inspection, with the general appearance of all minerals that come under his observation, and especially the more common species, as quartz, feldspar, mica, hornblende, limestone, etc. It is very desirable for the amateur geologist to have a collection of his own, of typical specimens of fifty or a hundred of the more common minerals and rocks, which, by the way, costs very little. If this is not convenient, he should not fail to visit the mineralogical collection in the rooms of some natural history society, which contains, in addition to all the common minerals, many rare and beautiful specimens from all parts of the world. It is only by careful study of the specimens themselves, object lessons, as it were, that any substantial knowledge of them can be gained.

Minerals are identified, or determined, as mineralogists say, by first noting their physical peculiarities, and afterward ascertaining their chemical composition.

We will now consider the physical characters of minerals:

1. About the first characteristic of a mineral to engage our attention, is its color. Colors, as relating to minerals, are of two kinds, essential and non-essential. The essential color of a mineral is its color when in a pure state. The non-essential is mainly the color of the impurities contained in the mineral. The essential color is found by powdering the mineral or rubbing it on any hard surface, as unglazed porcelain. The powder thus obtained is called the streak, and although the non-essential color may vary greatly, its streak is always nearly uniform. A mineral shows its true color when powdered, for the same reason that muddy water becomes white when beaten into foam and made opaque.

The essential color or streak of limestone is white or grayish white; its non-essential colors range from red, green, and yellow to blue, brown, and black. Common feldspar (orthoclase) may be white, gray, flesh red, or even green, as in Amazon stone, but its streak is uncolored.

Metallic minerals, those in which metallic elements predominate, are always opaque, and generally have essential colors, while vitreous or glassy minerals, which are more or less transparent, often have non-essential colors, because we can see into them and discern the impurities. Magnetite (an ore of iron) is a metallic mineral, and its color and streak are both black.

2. Closely related to color is the property termed luster, by which is meant the quality of the light reflected by a mineral as determined by the character of its surface. The two principal kinds of luster are the metallic and vitreous. The former is the luster of all true metals, and of nearly all minerals which are chiefly composed of metallic elements. An example may be seen in galena. The vitreous luster is the luster of minerals in which the non-metallic elements preponderate, as in vitreous quartz. There are various other kinds of luster, as adamantine, the luster of the diamond; resinous, the luster of resin; pearly, like pearl, as talc, pearl spar; and silky, as satin spar. When luster is entirely wanting, a mineral is said to de dull, as chalk and kaolin.

3. After the color, streak, and luster have been determined, the hardness is the next property that commands attention. In minerals there are all grades of hardness, from talc, which is impressible by the finger nail, to the diamond, the hardest of all known substances. To facilitate the determination of this characteristic a scale of hardness has been devised, as follows, beginning with the softest:

1. Talc.	6. Othoclase.
2. Gypsum.	7. Quartz.
3. Calcite.	8. Beryl or Topaz.
4. Fluorite.	9. Corundum.
5. Apatite.	10. Diamond.

Of any two minerals that which scratches the other is the harder, and by testing an unknown mineral by those given in this scale its degree of hardness can be ascertained. For instance, if we have a specimen that scratches calcite, but is scratched by apatite, we estimate its hardness at 4, but if it should also be scratched by fluorite, we would place it at 3·5. The hardness of all common minerals, however, as nearly as we need to get it in order to identify them, can generally be determined without recourse to the scale. The hardness of common window glass is about 6·5, and any mineral that will scratch it must be at least as hard as quartz; and any mineral that can be scratched by a knife cannot be much harder than 5·5. By the judicious use of the point of a knife and a piece of glass one can soon learn to estimate hardness well enough for practical purposes. In general, different specimens of the same mineral vary but little in hardness. There are exceptions to this rule, however, and some mineral species, as serpentine and calcite, vary greatly in this respect; the former ranging from 2·5 to 5·5, and the latter from 1 to 3·5.

4. The specific gravity or weight of minerals is one of their most constant characteristics. It is more difficult to discover, however, than hardness, and is therefore of less practical value as an aid in determining species. If the specimen is not too small, its weight can generally be estimated with sufficient accuracy for practical purposes by lifting it in the hand. Barytes or heavy spar can be readily distinguished from all minerals which it otherwise resembles by its much greater weight.

5. Most minerals occur more or less commonly in crystals, that is, in figures bounded by plane surfaces arranged regularly about a center. Minerals of the same species always crystallize in similar or allied shapes, and therefore the determination of the crystalline form is an important aid in identification. For instance, iron pyrites commonly crystallizes in cubes, thus rendering it easy to distinguish it from copper pyrites, which it sometimes resembles. Tourmaline and hornblende, when occurring in small fragments in rocks, are very similar in appearance, but the tourmaline can usually be distinguished by its long, slender, triangular crystals. In order to recognize any but the simpler forms of crystals a knowledge of crystallography, the science "which treats of the forms resulting from crystallization," is necessary, but as most minerals commonly occur uncrystallized, we are often obliged to depend upon other characteristics, and the determination of the crystalline form is seldom absolutely necessary.

6. Cleavage, or the tendency of a mineral to break along certain planes, is a property closely allied to the crystalline form, and is frequently useful in the identification of minerals. Common feldspar (orthoclase) can be distinguished from similar minerals by its peculiarity of breaking or cleaving in certain directions with a bright, even surface.

7. When a mineral does not occur, as is commonly the case, in distinct crystals, its general structure should be noted, whether it consists of an aggregate of fine grains like granular quartz, or forms a compact mass like flint or chalcedony. Notice if it is made up of a number of slender columns like some tourmaline, or of fine fibers like asbestos or satin spar. Sometimes a mineral has a lamellar structure, consisting of a succession of plates or leaves, like common mica. Again, it may be found in globular forms like marcasite (white iron pyrites), or in a shape resembling a bunch of grapes, termed botryoidal, like limonite or chalcedony. Minerals also occur coralloidal (coral-like) forms, as aragonite, or dendritic (tree-like) shapes, as magnetite (magnetic iron ore). Other species occur in stalactites or stalagmites, as limestone.

There are also many other imitative shapes in which minerals are found, such as amygdaloidal (almond shaped), reniform (kidney shaped), capillary (resembling a thread or hair), reticulated (net-like), acicular (resembling a needle), etc. In short, a careful examination of the general structure and imitative shape, if any, of a mineral will often lead to its identification without further trouble.

8. There are various other physical characters of minerals, such as magnetism, taste, odor, feel, tenacity, and phosphorescence, that are often useful in their determination. For instance, magnetite can be distinguished from minerals which it otherwise resembles by its property of being attractable by a magnet or magnetized knife blade; native alum by its astringent taste; kaolin or clay by its peculiar odor; and the hydrous silicates—talc, serpentine, and chloride—by their smooth or greasy feel. When two pieces of quartz are rubbed against each other they will emit light, or are phosphorescent. This is best seen in the dark.

The determination of the physical characters of minerals is, generally speaking, sufficient for the identification of all common, and also many uncommon, species, but there are many others that need to be tested chemically before their identification is rendered certain. This treatment is also necessary when the chemical composition of the mineral is to be ascertained, or the exact proportion of metal in an ore of silver, lead, copper, etc., determined. This latter process is called assaying.

We will now speak of the chemical characters of minerals.

Treating the mineral with acid is usually the first step. Calcite or common limestone can be readily recognized by its lively effervescence when touched with hydrochloric (muriatic) acid, while in the mass, but dolomite or magnesian limestone will only effervesce when powdered. Other minerals require the use of strong or hot acid. In addition to hydrochloric, sulphuric and nitric acids are often used. By the employment of acids the degree of solubility is determined, the presence of carbonic acid detected, and various other results obtained. After treatment with acids come the blowpipe tests. The mineral is placed upon charcoal, and submitted to the action of the flame of an alcohol lamp or gas jet directed upon it by the blowpipe. The degree of fusibility is noticed, the color of the flame noted, and also the character of the sublimates and the odor of the escaping gases. The mineral is heated in open and closed glass tubes, and then mixed with the fluxes—soda, borax, and salt of phosphorus. By these and other methods of treatment, and reference to a set of tables on the determination of mineral species, the exact status of the specimen in hand is finally decided.

The quantitative analysis of minerals, by which the precise proportion of each of their chemical constituents is found, requires a still more careful examination and additional treatment. A few words on the identification of rocks will not, perhaps, be out of place. To ascertain the peculiar species to which a rock belongs, it is only necessary to identify its constituent minerals, as, if we find a rock to consist of an aggregate of the minerals quartz and orthoclase promiscuously intermingled, we know it to be a binary granite; if it contains hornblende in addition, it is hornblendic granite. If a rock is composed of quartz and mica, it is mica schist; if a combination of hornblende and quartz, it is hornblende schist, and if it is simply a mass of grains of quartz firmly cemented together, we call it quartzite.

Many rocks, however, are so fine grained that it is impossible to distinguish the minerals of which they are made up, with the unaided eye. In such cases recourse is had to the microscope, which generally reveals the character of the constituent minerals without further trouble, but quite often we are obliged to go still further, and cut off a thin section or slice of the rock. This slice is mounted on a slide and carefully examined with the microscope, notice being taken of the reflected, transmitted, and polarized light, change of color, and various other peculiarities. The object is to ascertain the crystalline form, if any, of the minute particles of the minerals constituting the rock, the color, luster, and any other character possible. The science which treats of the determination of rocks by this method is termed microscopic lithology. Most specimens, however, can be identified without the aid of the microscope, so that a knowledge of this branch of the science of rocks is not indispensable to the amateur geologist.

* W. H. L., in *Kansas City Review of Science.*

A New Method of Preserving Hops.

The deterioration which hops undergo when stored under existing circumstances is well known, and is a serious loss to hop merchants and brewers, and many have been the attempts to devise a method of keeping hops, or of extracting their essential principles. Unfortunately, all preserved hops and so-called hop extracts are deficient in some constituents, and have never been in favor or come into general use among the brewers of this country.

A new method of extracting and preserving the essential principles of hops has lately been devised by M. Louis Boule, of Bourges, and the brewers of Belgium and the North of France have, says the *Brewers' Guardian*, already begun to avail themselves of the invention. It is well known that the fragrant aroma of the hop is for the most part contained in certain small glands, which can be separated from the rest of the hop flower, and which when separated constitute a yellow powder known as "lupuline;" this powder very easily undergoes decomposition, and the oil of hops, with which it is saturated, soon becomes oxidized in contact with the air, giving rise to valerianic acid, which imparts that unpleasant and "cheesy" smell to old hops. M. Boule proposes to mechanically separate this lupuline by the aid of a centrifugal machine, and to keep the powder in vessels completely protected from the air. Afterward the hops, which still retain all the bitter principle, tannic acid, and other useful soluble matters, are extracted by prolonged boiling with water, and this extract is subsequently evaporated and concentrated *in vacuo* at a temperature not exceeding 125° Fah. This extract is subsequently mixed with its proper proportion of lupuline, and the mixture is then placed and kept in airtight cans, much in the same way as our preserved foods are kept.

This preparation, which the inventor calls "normal hops," contains the whole of the extract—both volatile and fixed—of the hops, and can be kept unchanged for an indefinite period. The idea is that brewers should send their hops to be extracted in the manner we have indicated at special factories established for the purpose, and then have returned to them the whole of the essential principles in a concentrated and perfectly stable form.

BEHOLD, says a contemporary, referring to the exhaustless supply of petroleum and natural gas, what a few little holes in the ground can accomplish!

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ENGINEERING INVENTIONS.

An improved method of hardening steel has been patented by Mr. Ludlem B. Rockwell, of Sunbury, Pa. The articles used consist of cyanide of potassium, prussiate of potash, sal ammoniac, sulphate of iron, and bluestone, applied after a special manner during the tempering operation.

A car coupling has been patented by Mr. George H. Livingston, of Antes Fort, Pa. The invention covers a transversely movable drawhead and means for shifting it, with means also for moving the drawhead vertically, and means for moving and shifting the buffers.

A feed water return trap for steam heating apparatus has been patented by Mr. Denning P. Keating, of Ward's Island, New York city. This invention provides a novel construction and arrangement of parts to form a practical automatic device for returning the water of condensation of steam radiators back to the steam boiler.

A valve gear has been patented by Mr. Joshua P. McCook, of Richmond, Va. This invention covers a special construction of automatic valve gear, whereby the admission of steam is regulated according to the load, a peculiarity being a spring arrangement for normally holding the driving wheel in position in contact with the fly wheel or crank shaft.

A car coupling has been patented by Mr. James A. Arment, of Dodge City, Kansas. The drawhead has the ordinary link socket, with a vertically swinging self-coupling hook in a recess on one side, and a catch device for the hook of the opposing drawhead, with other features, by which the cars are coupled by two hooks, one on each car, both being detached by one movement of the lever of either hook.

A running gear for railway cars has been patented by Mr. Charles E. Candee, of New York city. This invention consists in improved journal boxes wherein friction rollers are employed, and in connection therewith a novel construction of axle, to reduce friction and wear to a minimum, and so the axle, rollers, and wheels can be readily and independently removed when worn out.

An automatic safety lock for locomotive furnace doors has been patented by Mr. Lewis B. White, of New York city. A casing is pivoted above the fire door, with a spring, and an arm for closing and locking the door, which casing can be locked to hold the arm raised by a bolt which is connected with a ball for automatically withdrawing the bolt when the locomotive collides with objects, or runs off the track.

A railway track clearer has been patented by Mr. Lewis Larchar, of Marble Rock, Iowa. A stock, having a pivotal and spring connection with the engine or car, is provided with a foot block carrying the clearer plates or cutters pivoted to the stock, to swing forward and backward, the block being held in normal working position by springs at its opposite faces; the block may also be made to swing laterally or held raised from the track.

A hand power mechanism has been patented by Mr. Eli Z. White, of Carrollton, Miss. It is made with a drive wheel mounted on a main shaft, which carries a loose rock lever, which in turn connects by rods with reversely set cranks of two shafts carrying drive wheels which act on the drive wheel of the main shaft, the crank shafts being mounted yieldingly, the whole making an inexpensive mechanism for driving railway hand cars or vehicles, or for operating light machinery.

AGRICULTURAL INVENTIONS.

A steam plow has been patented by Mr. Benjamin S. Benson, of Baltimore, Md. This invention combines a plow gang, a cutter bar, and a traction engine, the plow gang being arranged to neutralize the thrust of the plows and steer them, and for giving a free, independent, up and down motion to each plow in adapting itself to hollows and ridges on the surface of the ground.

MISCELLANEOUS INVENTIONS.

A clothes sprinkler has been patented by Clara O. Bilinski, of Diamond Lake, Ill. This invention covers a special construction and combination of parts to provide a simple, inexpensive device for sprinkling clothes for laundry and household purposes.

A heat insulating compound has been patented by Messrs. Carl Grunzweig and Paul Hartmann, of Ludwigshafen, Germany. It consists of asbestos, fossil meal, clay, soluble glass, disintegrated cork, and water, in certain proportions and prepared for use in a specified manner.

A ventilated barrel has been patented by Mr. Thomas L. Lee, of Memphis, Tenn. It has a middle inside hoop, and plain straight staves of uniform width sprung around it, to form the bulge, the staves being spaced and nailed to the middle hoop and the nails clinched.

A show case has been patented by Mr. Adam K. Bowman, of Greensburg, Pa. It is an upright case with glass doors, and having removable partitions and brackets, in which assorted yarns and similar goods may be conveniently stored and exposed for sale.

A music leaf turner has been patented by Mr. James P. Batchelor, of Hutchinson, Kan. This invention covers a special construction and combination of parts in a device, whereby the leaves of either book or sheet music may be turned by the performer without interfering with the rendering of the music.

A cement composition for moulding brick has been patented by Messrs. Richard B. Eason and John J. McGiveny, of New York city. The composition is composed of gypsum and ashes, treated in a specially described manner, to make a cement for use as a plaster, or to be moulded into brick or other forms.

A metal punch has been patented by Mr. Gilbert McDonald, of Augusta, Kansas. This invention relates to a former patented invention of the same inventor, and consists of the employment of a segmental ratchet arrangement to be operated by a pawl and lever for forcing downward the cutting or punching tool.

An axle gauge has been patented by Mr. Rufus A. Simpson, of Ferndale, Cal. This invention covers a special construction and combination of parts in a gauge for accurately measuring the set and gather of a wagon wheel, and for use in indicating accurately the exact set and gather for iron and steel axles.

A smoking pipe has been patented by Messrs. James W. Owens and Oscar McClure, of Washington, Mo. This invention relates to corncob pipes, and covers the filling of the interstices of the corncob with a peculiar composition, so that the pipe will not be permeable by nicotine, will not become discolored, and will have other advantages.

A brick has been patented by Mr. Arthur Sherry, of Learned Station, Miss. The bricks are made in square form with interior openings, so the bricks when laid can be bound together by a clay, mortar, or cement composition placed in the openings, the edges of the bricks being chamfered or rabbeted to protect the pointing from the weather.

A necktie and collar fastener has been patented by Mr. Frank D. Adams, of Auburn, Cal. This is a device to be used for preventing a necktie from working up out of place upon a collar, and consists of a pointed spring wire, with its body in the form of a letter S, and its ends so bent that it may be readily applied to keep collar and necktie in position.

An improved ring handle has been patented by Mr. Charles A. Cook, of New York city. Combined with a screw spindle, with a cap spun on its head, is an escutcheon plate through which the bolt is passed, the escutcheon having a raised part fitting in the open end of the cap, making a handle simple in construction and which cannot turn on its spindle.

A cheese cutter has been patented by Messrs. Monroe W. Chapel and Eugene A. Reynolds, of Grand Blanc, Mich. This invention covers a rotatable block with a standard, a peculiar spring, and a knife actuated in a novel way, making an improved device for cutting sector-shaped pieces from a head of cheese conveniently and rapidly.

A mole ditcher and tile layer has been patented by Mr. Andrew S. Hughes, of Ackley, Iowa. This invention embodies in one machine a capacity for both ditching and tile laying, for drain tile, regulating the beam so as to make a uniform level or grade of the bottom of the ditch on both ascending and descending ground, with other novel features.

A plating basket has been patented by Mr. Arthur Murphy, of Taunton, Mass. It is a vessel with projections on the upper surface of its bottom, connected by wires, which then pass through channels in the bail or handle, with a hook on the handle by means of which the vessel may be suspended in a plating solution from a suitable conductor.

A quarter boot has been patented by Mr. Thomas Golden, of New York city. This invention relates to devices attached to quarter boots of horses to prevent slipping, and covers a peculiarly shaped clip with points on its inner face and claws on its ends, in combination with the front strap of the quarter boot, to firmly engage the hoof of the horse.

A check hook for harness has been patented by Mr. Joseph Darling, of Karns City, Pa. This invention consists principally of a check hook adapted to slide through the saddle tree or back pad, and having a strap or cord attached to it for operating the hook to uncheck or check up the horse, so the driver can do it without leaving the carriage or vehicle.

A wardrobe bed has been patented by Mr. Ernst Doring, of New York city. It is constructed with an upright case and the bed frame connected by a bar having end shoulders, with other features, so that the fulcrum point will be changed automatically as the bed frame is raised and lowered, and the bed frame will be prevented from going too far in either direction.

A stationary automatic ice planing and ridging machine has been patented by Mr. Stephen L. Smith, of St. Louis, Mo. It consists in a combination of supporting bars, knives, and brooms, with the slideway over or through which the ice cakes are moved, and means of adjusting the parts, to cut off snow, slush, etc., and to ridge the cakes to prevent their freezing together.

A spring check hook for harness has been patented by Mr. William Black, of Morris, Pa. This invention relates to that class of check rein hooks wherein a coiled spring or elastic connection for the check rein is employed, the use of the spring allowing considerable freedom to the head of the horse, while by its use there is less liability of the horse breaking the check rein.

A combined wrench and gauge for gas service pipe cocks has been patented by Mr. Alfred G. Bayles, of New York city. It has a longitudinal slot in its handle with a pin secured adjustably therein to adapt the wrench to serve as a gauge, the slotted handle having a scale of division marks so the gauge pin can be readily set to prevent the cock from being opened beyond a fixed point.

A grader has been patented by Mr. Henry Hild, of Britt, Iowa. This invention covers a novel construction and arrangement of parts of a machine to plow up the earth and carry it the required distance to one side of the furrow, or load it into a wagon, and is designed especially for making roads by moving the earth from the ditch at each side to the center of the road.

An apparatus for charging liquids with gas has been patented by Mr. William Maynard, of New York city. Combined with a furnace for producing fumes or gases is a funnel, with pipes for conducting gas and water into it, the water gyrating along the sides of the funnel very rapidly, thus hydrating or purifying the gas, and drawing it downward into a gas receiver placed below the box.

A method for the production of rosaniline coloring matters has been patented by Mr. Emil Erlenmeyer, of Frankfort-on-the-Main, Germany. It consists of oxidation of various combinations or mixtures of methylated amines or anilines or rosanilines with primary, secondary, or tertiary amines in such a way that the methyls of the former compounds are applied under the influence of oxidizing media, etc.

NEW BOOKS AND PUBLICATIONS.

THE MANUFACTURE OF LEATHER. By Charles Thomas Davis. Henry Carey Baird & Co., Philadelphia. 8vo, 824 pages. $10.

This is probably the most complete work on the subject, but it is all the more important that it is an American work, for the only two volumes in the language that ever pretended to cover the whole trade have been long out of print, while in both French and German there are several treatises of considerable merit. This volume of Mr. Davis' is designed to cover a "description of all the processes for tanning, tawing, currying, finishing, and dyeing of every kind of leather, including the various raw materials and the methods for determining their values, the tools, machines, and details of the art," etc., together with a list of American patents pertaining to the business. It is illustrated by 302 engravings, and has 12 samples of dyed leather.

THE ARCHITECT'S AND BUILDER'S POCKET BOOK. By Frank Eugene Kidder. John Wiley & Sons, New York. Price $3.50.

The 586 pages of this handsomely printed pocket book are crowded with useful information, designed to make a complete and handy reference volume for those engaged in practical work. Briefly but comprehensively treating of the mathematics of building, it then more elaborately covers questions as to the strength and stability of foundations, walls, buttresses, piers, arches, posts, ties, beams, girders, trusses, floors, roofs, etc., and gives a great amount of condensed information on carpentry, masonry, draining, painting and glazing, plumbing, plastering, roofing, heating and ventilation, and kindred topics. The author is a civil engineer as well as a distinguished architect, yet the book is not intended to cover the more intricate problems of building naturally belonging to the civil engineer, but rather as a valuable aid and companion in the regular work which builders are ordinarily called upon for. The book is illustrated with 408 engravings, mostly from original designs.

Received.

INTEREST TABLES OF THE MUTUAL LIFE INSURANCE COMPANY, OF NEW YORK. By William H. C. Bartlett, Actuary.

NEW YORK PRODUCE EXCHANGE ANNUAL STATISTICAL REPORT, FOR 1883. By E. H. Walker.

THE CHILDREN OF THE BIBLE. By Fanny L. Armstrong, with introduction by Frances E. Willard. Fowler & Wells Co., New York.

SMOKING AND DRINKING. By James Parton. Fowler & Wells Co., New York.

NOTES ON THE OPIUM HABIT. By Asa P. Meylert. G. P. Putnam & Sons, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Anti-Friction Bearings for Shafting, Cars, Wagons, etc. Price list free. John G. Avery, Spencer, Mass.

Blake's Patent Belt Studs. The strongest and best fastening for Rubber and Leather belts. Greene, Tweed & Co., N. Y.

Scientific Works by Huxley, Tyndall, Spencer, etc., very cheap. J. Fitzgerald, 20 Lafayette Place, New York.

Every one interested in Firearms and Sporting Goods should send for the Catalogue issued by Messrs. J. A. Ross & Co.; also their 1885 Calendar. See advertisement in this issue.

Correspondence solicited with any one having novelties, inventions, or patented articles of merit to introduce in Eastern market; office central; salesmen experienced. Address Chas. A. Post, 31 Astor House, N. Y.

For Sale.—SCIENTIFIC AMERICAN, vols. 1 to 40; well bound; good order. G. W. Pearsons, W. W. Office, Kansas City, Mo.

Linen Safety Hose, all sizes, for hotels, warehouses, and steamboats. Greene, Tweed & Co., New York.

Forced Sale.—Drill Presses. S. M. York, Clev'd, O.

For Sale.—Steel Figures, $1 per set. S.M. York, Clev'd, O.

Whistles, Injectors, Damper Regulators; guaranteed. Special C. O. D. prices. A. G. Brooks, 261 N. 3d St., Phila.

Agents with $2 capital wanted. Brown, Elliott & Spears, Silver Creek, N. Y.

Experimental Machinery Perfected, models, patterns, etc. Tolhurst Machine Works, Troy, N. Y.

Brush Electric Arc Lights and Storage Batteries. Twenty thousand Arc Lights already sold. Our largest machine gives 65 Arc Lights with 45 horse power. Our Storage Battery is the only practical one in the market. Brush Electric Co., Cleveland, O.

The Cyclone Steam Flue Cleaner on 30 days' trial to reliable parties. Crescent Mfg. Co. Cleveland, O.

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Mills, Engines, and Boilers for all purposes and of every description. Send for circulars. Newell Universal Mill Co., 10 Barclay Street, N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

For Power & Economy, Alcott's Turbine, Mt. Holly, N.J.

Steam Boilers, Rotary Bleachers, Wrought Iron Turn Tables, Plate Iron Work. Tippett & Wood, Easton, Pa.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty, St., New York.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423. Pottsville, Pa. See p. 422.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 438.

Curtis Pressure Regulator and Steam Trap. See p. 14.

Woodwor'g Mach'y, Rollstone Mach. Co. Adv., p. 14.

Drop Forgings, Billings & Spencer Co., Hartford, Conn.

Brass & Copper in sheets, wire & blanks. See ad. p. 438.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 5,000 Gear Wheels now in use, the superiority of their Castings over all others. Circular and price list free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Hoisting Engines. D. Frisbie & Co., Philadelphia, Pa.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 438.

Pays well on Small Investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday-schools, and home amusements. 136 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

Renshaw's Ratchet Drills. No. 1, $10; No. 3, $15. Cash with order. Pratt & Whitney Co., Hartford, Conn.

Shipman Steam Engine.—Small power practical engines burning kerosene. Shipman Engine Co., Boston. See page 29.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. T. L. asks a receipt to convert a white rubber coat to a black. A. It is impossible. The black color is due to substances added to the rubber during the process of manufacture.

(2) J. H. asks: What acid or combination of acids will eat hard brass away quickly? A. Nitric acid or nitro-muriatic acid.

(3) E. F. asks if there is any way by which a violin can be improved in tone so as to be able to make it worth more, and would like to know if varnishing a violin affects its tone any. A. The tone of a violin improves with age and by continual playing. We should not advise its varnishing, as it is not likely to improve the tone.

(4) F. S. D. desires a recipe for making a mucilage for library labels. A. Try the following:

Gum dextrine	2 parts.
Water	5 "
Acetic acid	1 "

Dissolve over a water bath by means of heat, and add one pint spirits of wine.

(5) F. A. W. writes: Will you give me a simple test to determine the presence of glucose in cane sugars? A. Dissolve some of the suspected sugar in water, and add Fehling's solution; if grape sugar is present, a precipitate of the red oxide of copper will form, while with cane sugar no effect is observed.

(6) C. T. asks how to ebonize whitewood. A. Dissolve 4 ounces shellac with 2 ounces borax in half a gallon water. Boil until a perfect solution is obtained, then add half an ounce of glycerine, after which add sufficient aniline black soluble in water, and it is ready for use.

(7) J. H. writes: I wish to paper some rooms in my house. The roaches are inclined to eat the paste; will you tell me how I can keep them from doing so? A. Use an ounce of poke root boiled in a pint of water, and mix the extract with the paste.

(8) P. & Co. ask for a receipt for suitable ink used with a stylographic pen, and that will copy; it requires to be very limpid and fluid. A. The inks used with the stylographic pen are generally aniline

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inks, and consist of nigrosine, soluble, dissolved in sufficient water; a little sugar or glycerine can be added to make it a copying compound, but we doubt if good copying ink can be used with such a pen long.

(9) E. H. B. asks a good and cheap way to prepare a soft pine floor to be used for a skating rink; want something to fill cracks with, that will stay. A. We know of nothing better than the wood itself. The floor plank should be dry and well driven together. No cement that we know of will make a solid filling suitable, for roller skating. We advise the use of maple for the floor; white pine is too soft.

(10) H. S. asks how to use the tin foil which comes round tobacco, for soft soldering? A. Add 50 per cent of tin. 2. How is Vienna lime used to polish steel? A. Wet the Vienna lime to a paste. Apply to buff, and finish dry.

(11) M. D. L. M. desires a receipt for clearing and purifying sorghum molasses that is old and glutinish with dregs settled at the bottom. A. First blow the molasses up with steam, then neutralize with lime, and inject sulphurous oxide, which will bleach the mixture, and finally run through the bag filters and boil down.

(12) W. H. A. asks: Is there a process for reworking or improving stale or inferior butter? A. Butter that is rancid may be restored, or in all cases greatly improved, by melting it in a water bath with some freshly burned and coarsely powdered animal charcoal (which has been thoroughly freed from dust by sifting), and straining it through clean flannel. A better and less troublesome method is to well wash the butter first with some good new milk, and next with cold spring water. Butyric acid, on the presence of which rancidity depends, is freely soluble in fresh milk.

(13) C. H. K.—We are not acquainted with the compound mentioned, but presume that it is similar to the menthol cures recently placed on the market. These are prepared as follows: Neuralgia cures are usually composed of menthol or a mixture of menthol, thyme, and eucalyptol to about equal parts of paraffine or spermaceti. When applied a burning sensation similar to that of menthol is first produced, generally followed by relief.

(14) H. D. J. asks (1) a formula for making a paint or cement, acid proof, for lining wood bath vats for plating. A. The following is from one of our back numbers: Melt together 1 part pitch, 1 part resin, and 1 part plaster of Paris (perfectly dry). A good asphalt varnish, if allowed to dry properly and completely, will also stand. 2. What is henequin, mentioned in SCIENTIFIC AMERICAN of December 6? A. Its botanical name is Agave sisalana, or, as it is more commonly called, Sisal or grass hemp.

(15) J. H. R.—Dust on belts is sometimes a source of trouble, but we can give no better advice than to try and keep a belt as nearly as possible in the condition in which a good manufacturer would furnish it, by occasional treatment with a little neatsfoot oil. Most of the slipping of belts comes from their being overloaded, or not properly laced up after the "stretch" has been taken out of the leather.

(16) M. S. asks (1) if there are any means by which I can construct a sandblast for the manufacture of small glass signs, and if so, how shall I go to work to make it? Can I mould small glass letters in a plaster Paris mould? A. You will find the sand blast described in SCIENTIFIC AMERICAN of January 29, 1881. Articles in glass are generally cast in metallic moulds, or else in wooden forms, and we do not think that plaster would be suitable. 2. I saw in a back number of the SCIENTIFIC AMERICAN a formula for an etching ink for glass. Where can I get it prepared? A. A description of the etching ink is given on page 211 of SCIENTIFIC AMERICAN, for April 5, 1884. It can be prepared by any competent pharmacist.

(17) E. N. N. writes: On page 299, in answer to No. 27, you say that a bar placed square is as 673 to 568 to a bar of same size placed diagonally. I am very desirous to know whether this is the case. Take, for instance, a buggy axle 1 inch, and place it square; will it require more strain in usage to bend that, than though placed diagonally? I see some of the express companies' wagons have the axles diagonally, and was about to have some spring wagons so made, when I chanced to see the answer above referred to. A. The answer is correct. The diagonal arrangement of axle is derived from the idea that the principal strain is neither horizontal nor vertical, but compounded of both, as you will see by analyzing the direction of the thrust when a wheel strikes an obstruction. You will find it as nearly as possible in the direction of the lines of the square when placed in the diagonal position.

(18) F. M. B. writes: I wish a receipt for making hard water soap, which will equal or surpass any used in this country, where alkali water prevails. Tallow is the grease I wish to use. A. It will be found exceedingly difficult to prepare a soap, such as you desire from tallow; cocoanut oil is generally used. The following, however, is a reliable recipe, being the formula for Dawson's Patent Composite Soap: Strong potash lye, 75 pounds; tallow, 75 pounds; cocoanut oil, 25 pounds. Boil until the compound is saponified in the usual manner, and perhaps may prove satisfactory.

(19) R. W. asks: What will remove coal tar from the surface of hot water heater pipes, in a greenhouse? The fumes from the tar destroy the plants. What treatment would you recommend under the circumstances? A. There is no safer way to remove the coal tar than to scrape it off the pipes with steel scrapers. You may wash it off with benzine or naphtha, but you will have to let the heat down, as the evaporation of the benzine or naphtha will give more trouble than the coal tar. The coal tar ought to dry in a short time, and thus relieve you of the trouble.

(20) S. E. F. asks for a receipt for waxing soap wrappers after they are printed. A. Ordinary waxed paper is prepared by placing cartridge or other paper on a hot iron, and rubbing it with beeswax or by brushing in a solution of wax in turpentine. On a large scale, it is prepared by opening a quire of paper flat upon a table, and rapidly ironing it with a very hot iron against which is held a piece of wax, which melting runs down upon the paper and is absorbed by it. Any excess on the topmost layer readily penetrates to the lower ones.

(21) H. J. writes: 1. I have made dynamo one-half larger and similar to that in SUPPLEMENT No. 161, fields wound with No. 12, armature with No. 16. It does not work satisfactorily; will only heat about one inch of No. 36 iron wire to a bright red. Is built according to plan in every particular, except the space between poles of field magnets is only ½ inch instead of 1⅛ inches; as in plan. Is this the defect? It is about the only one I can find; have wound armature with Nos. 12 and 20 with no better success; speed 1,495 revolutions per minute, runs noiseless with open circuit, but rumbles when closed on short circuit; slot in commutator ⅛ inch out of square. Insulation good between magnet cores and wire, as tested by telephone and battery. Can you help me discover the difficulty? A. Your difficulty probably arises from having the poles of your field magnets too near together. 2. About how many 10 candle power lamps (incandescence) ought it to run? A. It might run two such lamps, provided the speed of the armature was sufficiently high. 3. What kind of steel is used for permanent magnets, and how tempered, especially telephone magnets? A. Chrome steel is considered the best. The magnets are hardened only at the ends, and drawn to a light straw color. 4. Can I make a louder speaking receiver than Bell's form, something to be heard across an ordinary room? A. We know of no telephone receiver that can be heard at any great distance, excepting Edison's Electro Mechanical Telephone; if you succeed in making a telephone that can be heard distinctly across the room, you will have produced something far in advance of anything we have at present.

(22) H. A. F. asks: 1. What is the microphone used for? A. Many of the telephone transmitters now in use are simply microphones. 2. On what principle is it constructed? A. A microphone consists mainly of two pieces of carbon or other semi-conductor placed loosely in contact with each other and vibrated by a diaphragm to which one of them is attached. See SUPPLEMENT, Nos. 163, 400, 347. 3. Is it of any great value as a scientific discovery? A. Yes. 4. Do you think there is much room for improvement on the telephone? Would you think it worth while to try? A. Certainly telephones better than those now in use are required, and any marked improvement would be sure to pay.

(23) E. M. H. asks for the method of finishing picture mouldings. Of what is the first or (as I suppose) plaster of Paris coat composed and how applied, and of what is the compound of the gilt and dark finish? A. The composition for moulding is prepared as follows: Mix 14 pounds of glue, 7 pounds resin, ½ pound pitch, 2½ pints linseed oil, 5 pints of water, more or less according to the quantity required. Boil the whole together, well stirring until dissolved, add as much whiting as will render it of a hard consistency, then press it into a mould, which has been previously oiled with sweet oil. No more should be mixed than can be used before it becomes sensibly hard. Gold size is then put on, several coats being considered necessary, then the gold leaf itself, which is burnished in course of time, and finally covered with finishing size.

(24) H. L. K. asks a receipt for making photo dry plates, emulsion process. A. You will find this information given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 205. 2. Also a book or manual on fancy dyeing, consisting of, namely, silks, satin, etc., giving receipts for manufacturing the dyes, and their substance. A. There are many books on this subject. One of the best is: The American Practical Dyer's Companion, by F. G. Bird, price $10.00; the Dyer and Color Maker's Companion, 12mo, $1.25, is a much smaller book.

(25) S. A. D. desires a colorless lacquer for yellow cedar and a good ebony stain. A. For a colorless lacquer: Dissolve 2 ounces gum sandarac and ½ ounce gum mastic in one pint alcohol. When dissolved add 5 drops glycerine. For the black: Take four ounces shellac, 2 ounces borax, and boil in half gallon water until dissolved, then add ¼ ounce glycerine, and finally sufficient aniline black, soluble in water. This stain gives very satisfactory results if properly used.

(26) M. W. asks for receipt for darkening new mahogany to imitate old mahogany. A. To darken mahogany: Put 2 ounces of dragon's blood, bruised, into a quart of oil of turpentine; let the bottle stand in a warm place, shake frequently, and when dissolved, steep the work in the mixture.

(27) R. asks about how much kaolin is used in America, and how much is exported. How much does it bring per ton, and where can it be sold? What per cent of iron is required in ocher for paint? A. No exact information as to how much kaolin is used or the quantity exported is obtainable. Its value depends upon its quality, which varies widely. The iron ochers contain from 30 per cent of iron oxide upward. Their value depends largely upon their condition, whether soft and free from grit, etc.

(28) W. G. McC. asks how to make luminous ink with phosphorus, and how to use it—the very best process. Is there any way to make it the consistency of beeswax, so one could mark on paper, the mark showing only in the dark, and use it with safety in handling? A. Phosphorus itself can be used to mark on paper and then can be distinctly seen at night, but it is a dangerous substance to handle. We believe there have been no successful attempts at making either luminous ink or paint in this country, though the latter is made in England and handled by a large New York house.

(29) H. S. writes: October 25, 1884, in answer to query No. 22, you gave directions for making a reversed blue print, also black lines on white ground. I tried them both, and inclose samples of each, a flat failure. What is the trouble? A. If properly followed, the process will give good results. The samples sent show too long an exposure, and have apparently been prepared by the blue process itself.

(30) J. M. asks for some process by which lamp chimneys can be hardened. A. Glassware of all kinds is annealed by gradual heating and subsequent slow cooling. The operation at the works sometimes takes quite a long while. For practical purposes an easy method consists in simply putting the chimneys into cold water, and slowly heating until the water boils and then allowing the water to cool again. This operation repeated several times will bring about the desired result.

(31) C. C. H. asks: What will remove claret wine stains from linen table cloths and napkins, also from body Brussels carpet? A. Apply a little table salt to the spot stained, and also moisten it with sherry. After washing, no trace of the stain will be left. The acid contained in the claret decomposes the salt, setting free chlorine (bleaching gas), which removes the vegetable coloring matter of the wine. See also table giving directions for removal of various stains in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(32) H. D. J. writes: Can water and sweet oil or castor oil be thoroughly amalgamated without showing their separate parts and qualities? What is the smallest amount of water that will thoroughly dissolve 1 ounce potassa permanganate crystallized? This solution being made, how can it be mixed with oil without showing the resistance of the water to combine itself with wax? A. Neither castor oil nor olive oil is soluble in water. Sometimes a small proportion of water can be mixed with the oils, but not satisfactorily. One part of potassium permanganate is soluble in 16 parts of water at 15° C. The oils would decompose the potassium permanganate, and therefore we do not see how a satisfactory mixture can be prepared.

(33) P. W. J. writes: I want to make a telescope. 1. What is the best lens—a double or plano-convex eye glass? A. For full information on the construction of a telescope, see article on this subject in SUPPLEMENT, No. 252. Use an achromatic object glass, which consists of a double convex crown glass lens and a plano or concavo convex flint glass lens. 2. What is the meaning of 1 inch diameter, 2 inches focus lens? A. The diameter of the lens would indicate its breadth, and the focus of the lens as generally understood is the principal focus, or the point at which the image is produced. 3. What size object glass will the above require, and what will be its power? Also what length tube will it require? A. It is probable that a 2½ inch object glass will meet your wants.

(34) E. C. asks how to make extract of lemon and extract vanilla such as is used in cooking. A. Extract of lemon is prepared by exposing four ounces of the exterior rind of lemons in the air until partially dry; then bruise in a Wedgwood mortar; add to it two quarts deodorized alcohol of 95°, and agitate until the color is extracted; then add six ounces recent oil of lemon. If it does not become clear immediately, let it stand for a day or two, agitating occasionally. Then filter. For the vanilla, cut one ounce vanilla into small pieces and triturate with two ounces sugar to a coarse powder; put it into a percolator, pour on it diluted alcohol until one pint has run through, then mix with one pint sirup.

(35) E. M. C. asks: Is there any way of softening the putty on old sash so as to get the glass out without breaking? A. Take 1 pound of American pearl ash, 3 pounds of quick stone lime; slake the lime in water, then add the pearl ash, and make the whole of the consistency of paint. Apply it to both sides of the glass, and let it remain for twelve hours, when the putty will be so softened that the glass may be taken out of the frame with the greatest facility.

(36) G. W. B.—I notice in your paper of December 13, that G. W. B. asks what will prevent shellac from turning dark after being mixed for some time. Tell him to keep his shellac in a glass or earthen vessel, and see that his brush is neither tin nor iron bound, and he will have no difficulty; it is contact with iron that turns the shellac dark.—E. W. L.

(37) R. N. writes: I have been requested to refer a disputed question to you. It is this: A tubular boiler 60 inches diameter by 14 feet long, set in brick, 60 3½ inch tubes, stack 30 inches diameter, 48 feet high, ample grate surface, fuel common pine (not fat pine). Evaporates 3,607 pounds water in one hour. Temperature of water feed by injector 76°; injector run by steam from boiler. What horse power is the boiler? A. Your boiler is 60 horse power.

(38) S. L. asks if it is possible to construct a working model of a compound condensing screw engine (two cylinders, say ¾x1½ for small, 1½x1½ large), and says: "I am told that it will not work unless I can raise steam to 90 pounds, and there is difficulty in the expansion also." A. Your engine is entirely too small to gain any advantage from the compound form.

(39) A. V. R.—We are of the opinion that of two stoves exactly alike, the one with thin clear mica around the upper part will radiate more heat through the mica than would be radiated if the panels were filled with iron. Iron gives out the most heat by convection, or the circulation of air over the surface. It is also a stronger radiant than mica, but the mica has the advantage of being transparent to the direct radiation of a red hot fire.

(40) A. C. G. asks if there is anything that I can add to a solution of nitric acid that will stop its action on metals, the article added not to exceed one-quarter the weight of the acid, and to thoroughly mix with it. A. You can neutralize the effect of the acid by adding any of the alkalies; the carbonate of soda or commercial soda ash will probably be the least expensive. Dilution by water is likewise an excellent plan. Heat the solution until the nitric acid is driven off and then add water, will perhaps be found suitable.

(41) F. J. R.—For your safety valve multiply the area of the valve by the pressure that you wish to carry, divide this sum by the weight of the ball in pounds. The quotient will be the number of times that the distance of the ball should be from the fulcrum, in parts of the distance of the center of the pin from the fulcrum. To get the area, square the diameter and multiply by 0·7854. See SCIENTIFIC AMERICAN SUPPLEMENT; No. 13, "How to Set a Slide Valve." We do not know what you mean by 6, 8, and 10, unless to make a square. Any other numbers will answer that have the same proportion. Practice has found these the most convenient.

(42) L. R. writes: The arm below the elbow of a statue, sold as being of stucco, is broken. I tried to stick a loose small piece with plaster of Paris, but failed; it gets dry before I manage to adjust it. Would you suggest a remedy? A. We think you were right in using plaster of Paris. Mix finely powdered plaster of Paris into a cream with water, and apply it at once; will probably prove successful. Yellow resin 2 parts melted and stirred in with an equal amount of plaster of Paris is sometimes used. In the latter case the cement is to be applied hot, and the surfaces to be united must previously be heated.

(43) S. W. F. writes: What is the remedy to remove warts and moles from the face and not be injurious to the skin? A. Croton oil under the form of pomade or ointment, and tartar emetic under the form of plaster or paste, have been successfully employed for the removal of moles. For warts see SCIENTIFIC AMERICAN of October 3, 1883.

(44) D. S. C. asks what the difference is between whiting and Paris white, or sometimes it is called cliffstone, or what is the difference between it and common chalk, and why is it called Paris white? A. Whiting and Paris white are practically the same article in different degrees of fineness, both being simply chalk, ground, elutriated, balled, and dried. Cliffstone is a better and harder variety of chalk, and is the one generally used for the preparation of Paris white. The Paris white is considered the better article; it is more carefully washed and more slowly dried than the ordinary whiting.

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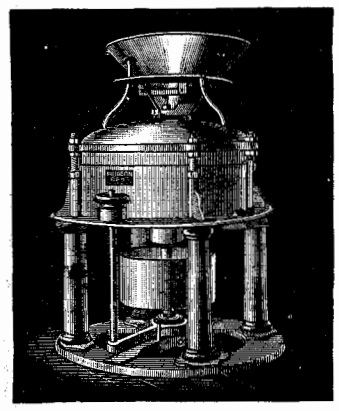

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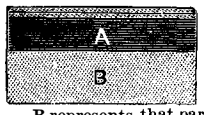

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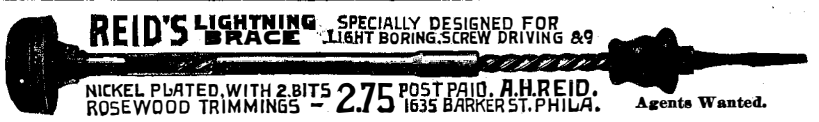
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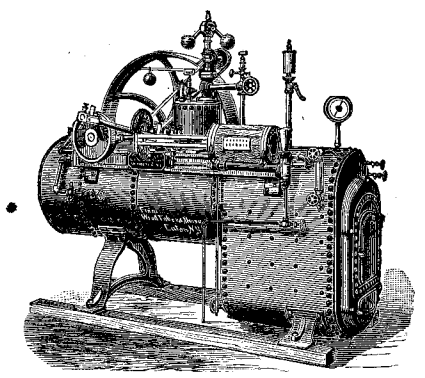

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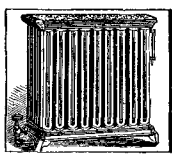

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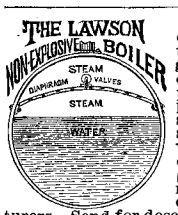

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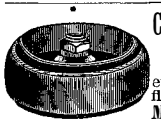

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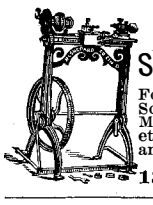

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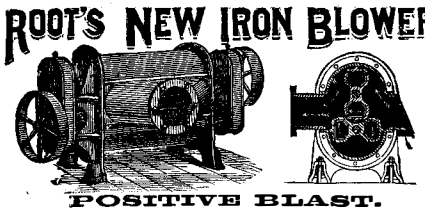

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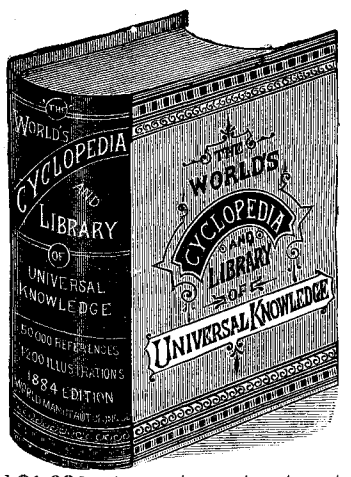

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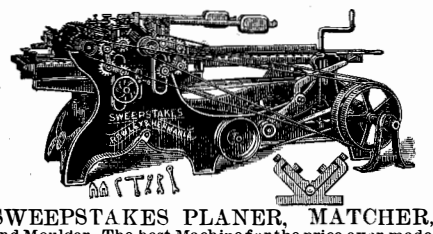

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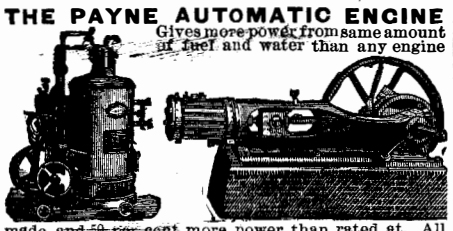

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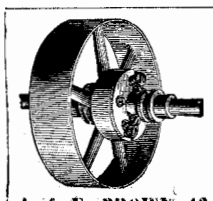

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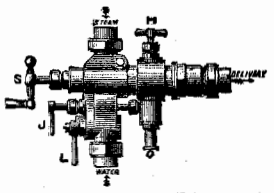

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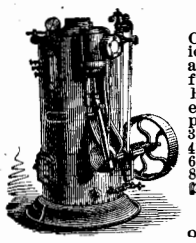

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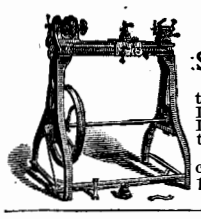

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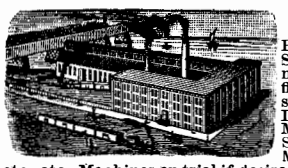

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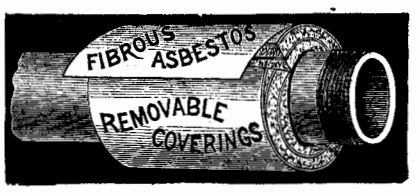

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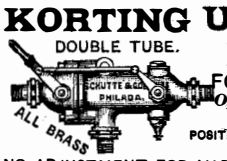

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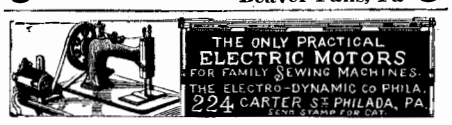

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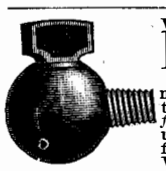

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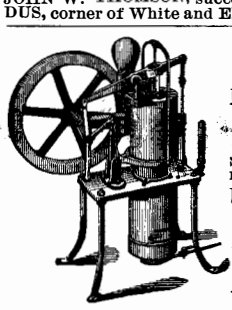

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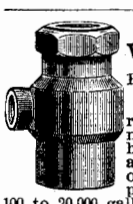

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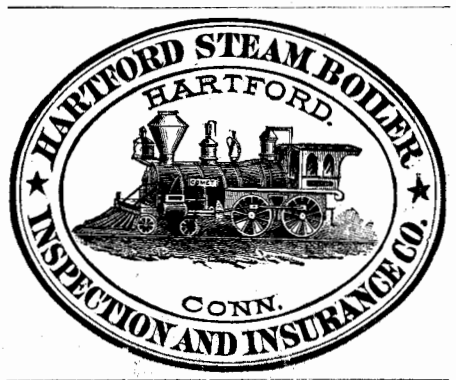

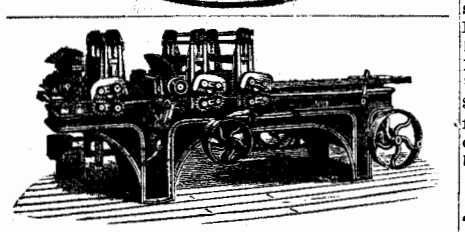

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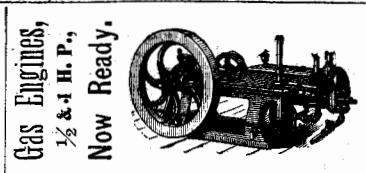

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